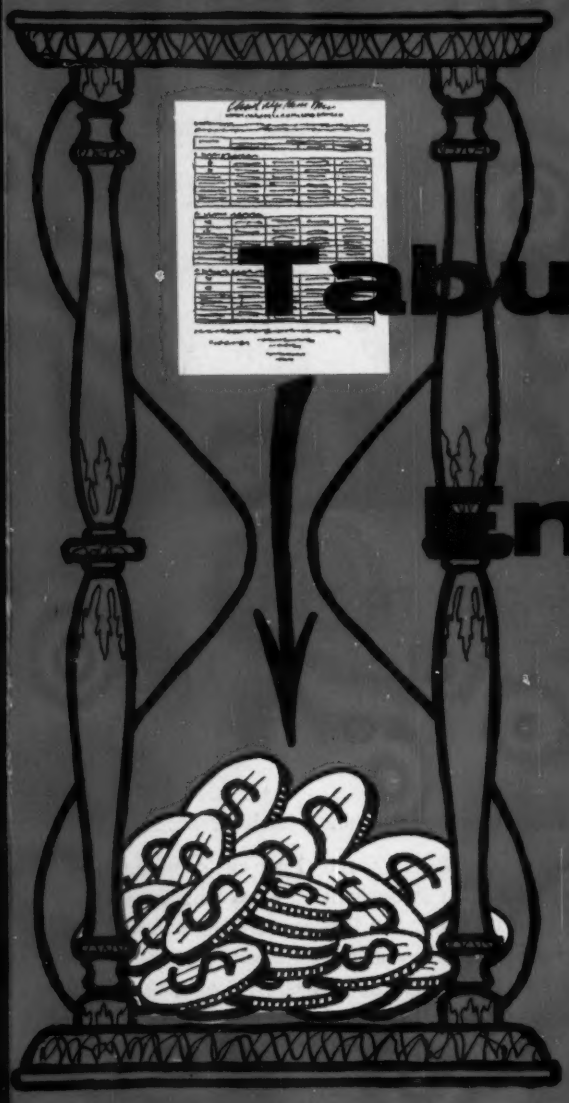
The Electrical Industry's Weekly Magazine

May 27, 1957

Electrical World

Price 50 Cents

A McGraw-Hill Publication

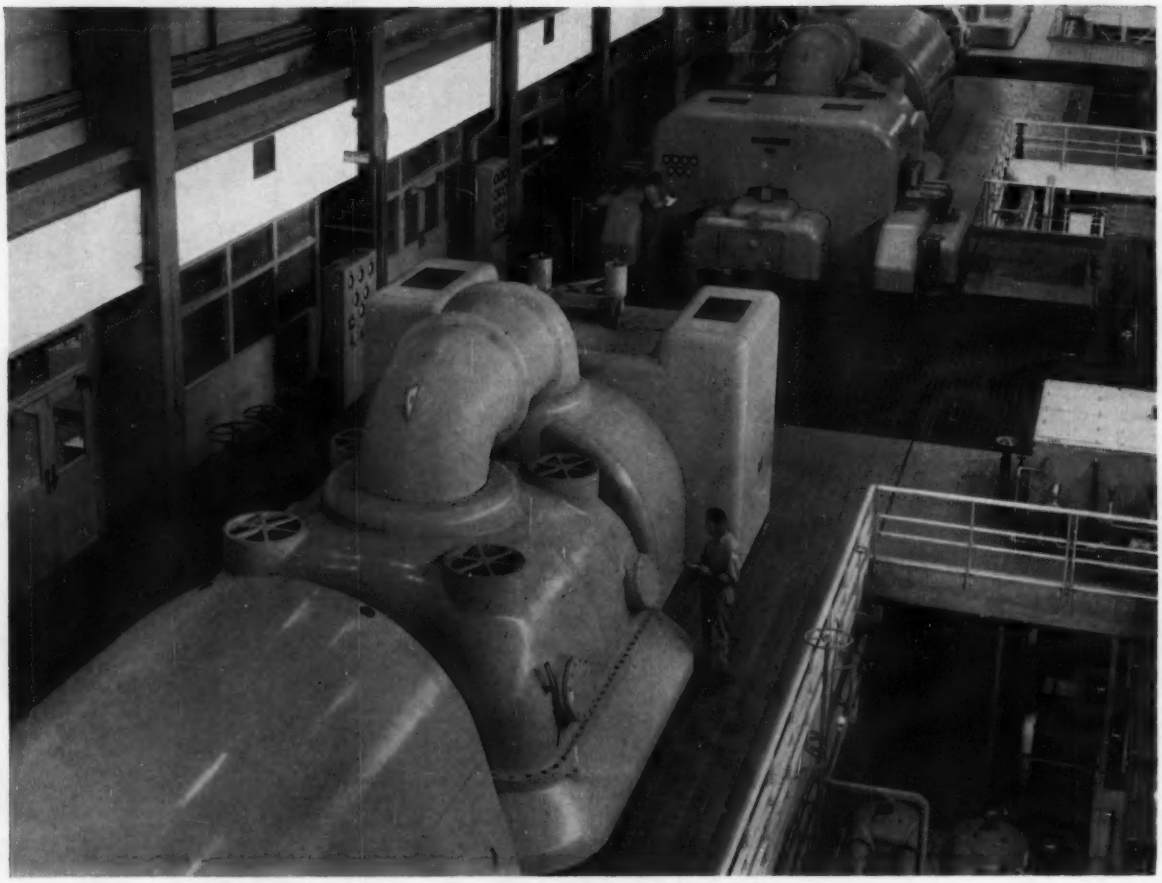


Tabular Forms Reduce Engineering Time by 85%

...Page 78

Line Contractors Shift Into High Gear . . . Page 66

E B POWER GS W I
UNIVERSITY MICROFILMS I
313 N 1 ST
ANN ARBOR MICH



To keep turbine performance at an efficient high

Texaco Regal Oil R&O

Regardless of operating conditions, turbines lubricated with *Texaco Regal Oil R & O* can be depended upon to perform efficiently under peak and valley loads alike.

The reasons for the superiority of *Texaco Regal Oil R & O* over ordinary turbine oils are compelling:

- It prevents sludge, rust and foam, assures normal bearing temperatures and instantaneous governor response.
- It meets the exacting requirements of all leading turbine builders regardless of turbine type, size or special features.

With *Texaco Regal Oil R & O* you can count on extra-strong protection throughout an extra-long service life.

A Texaco Lubrication Engineer is trained to help you select the right turbine oil from Texaco's complete line of *Regal Oils R & O*. Just call the nearest of more than 2,000 Texaco Distributing Plants in the 48 States—or write The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

TEXACO Regal Oils R&O

FOR ALL TURBINES

Electrical World

Vol. 147, No. 21 MAY 27, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Features

CURRENT EVENTS

Line Contractors Start Another Good Year
Utility transmission and distribution construction means $100 million a year business....p 66

New Indiana Co-op Plans 264-Mw Steam Plant
Would serve rural customers and possibly an aluminum producer. Electric companies are objecting....p 68

It's TV vs Newspapers at PUAA Meeting
Annual convention also hears about "brainstorming" and motivation studies as aids to daily work....p 72

MANAGEMENT

Girl Clerks Ease Engineer Shortage
High school graduates with flair for mathematics make simplified load and voltage studies....p 76

DISTRIBUTION

Tabular Forms Reduce Engineering Time
Florida P&L develops easy-to-use forms that simplify application of secondary capacitors to 3-phase banks....p 78

GENERATION

Liquid-Cooled Stator Is Success
260-Mva generator has seven months' satisfactory operating record using transil oil as coolant....p 82

Forced-Air-Cooled Bus Good for 10,000 Amp
Preliminary field tests on an actual isolated-phase bus installation have proven satisfactory....p 85

Control Boards Face Operator
Single room at Cleveland El's Eastlake Station houses all electrical control and relay boards....p 87

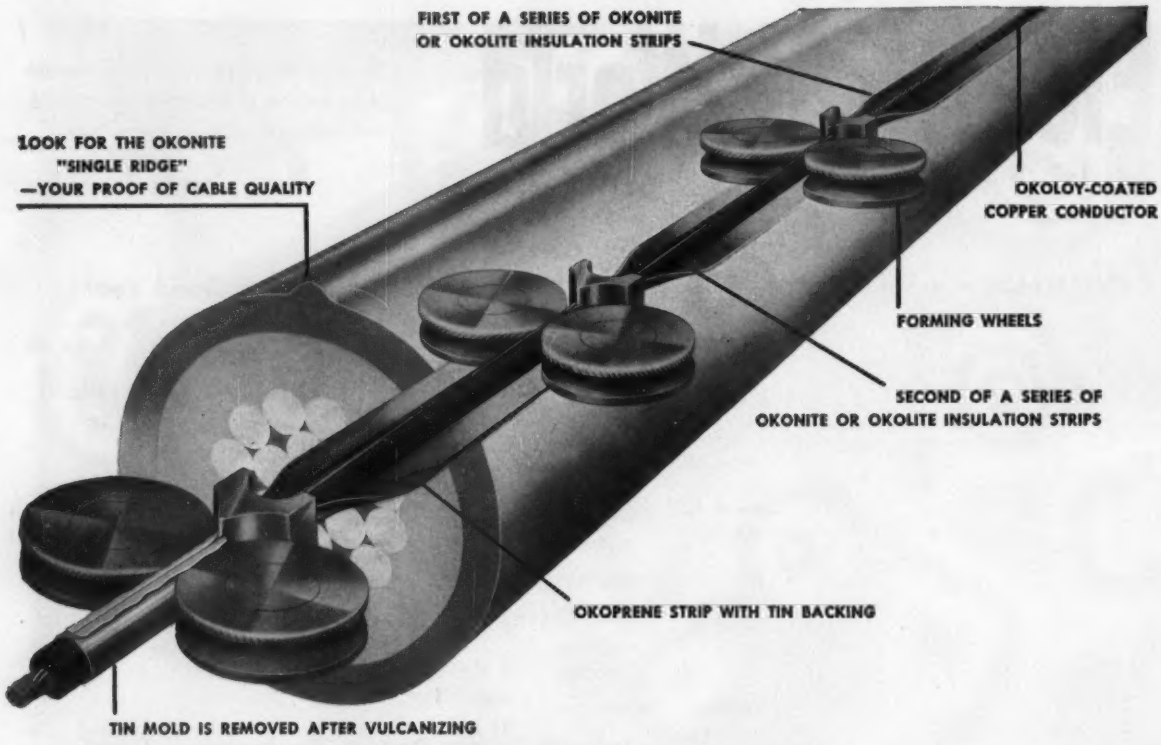
TRANSMISSION

Builds Accuracy Into Fault Locators
Addition of another range calibrator has built accurate range calibration into standard radar-type fault locator...p 88

Departments

Atomic Progress 70
Books 124
Catalogs and Bulletins..... 120
Editorials 65
• Electrical Newsletter 19
From the Publisher..... 5
How To 90
• Management Newsletter 125
Manufacturers and Markets..... 133
Meetings Calendar 140
Meeting Reports 74
New Equipment 109
News About People 136
News-Beat 71
Selling 96
Technical Literature 120
Washington Wire 69

INDEX TO ADVERTISERS..... 147


FIRST OF A SERIES OF OKONITE OR OKOLITE INSULATION STRIPS
LOOK FOR THE OKONITE "SINGLE RIDGE" —YOUR PROOF OF CABLE QUALITY
OKOLOY-COATED COPPER CONDUCTOR
FORMING WHEELS
SECOND OF A SERIES OF OKONITE OR OKOLITE INSULATION STRIPS
OKOPRENE STRIP WITH TIN BACKING
TIN MOLD IS REMOVED AFTER VULCANIZING

Why the strip-insulating process assures longer cable life

As one of the oldest manufacturers of rubber-insulated cable, Okonite has made cable by all the known methods, namely the extrusion, dip and strip-insulating processes.

Long experience with these methods has convinced Okonite engineers that the strip process produces cables which are longer-lived and more reliable than those made by other methods. The following advantages explain why Okonite-Okoprene and Okolite-Okoprene cables are made by this method.

Perfectly centered conductors. The strip process is the only one that assures perfect centering of conductor. Insulation is uniform in thickness throughout cable length. There are no "thin spots."

Uniform vulcanization. Vulcanizing under pressure in a continuous metal mold makes the insulation tougher, more dense; physical and electrical characteristics are improved.

Single cure. Vulcanizing insulation and sheath in one operation is possible only with the strip process, thus avoiding shortened insulation life. Multiple vulcanization shortens the life of rubber compounds.

Strong bond. Single, simultaneous vulcanization in a metal mold under pressure insures permanent bond between insulation and sheath. This prevents "push backs" during installation, ionization at potentials above 2000 volts and water blisters in wet locations.

Quality control. Unlike any other method, the strip process permits electrical testing and visual inspection of each strip of insulating and sheathing compound both prior to and during application. These controls assure a void-free, uniform, solid dielectric wall.

Cables manufactured by this strip process have outstanding performance records. Next time you purchase cable for any circuit installation, insist on the *one* cable made by the strip-insulating process . . . specify Okonite-Okoprene or Okolite-Okoprene. For a full review of strip-insulating advantages, write for Bulletin EW-1069; The Okonite Company, Passaic, New Jersey.

where there's electrical power . . . there's **OKONITE CABLE**

Electrical World Staff

Fischer Black Publisher and Editor

Daniel T Braymer Assistant to the Editor

Engineering

Leonard M Olmsted Managing Technical Editor
John J Kearney Assistant Managing Technical Editor
Howard S Knowlton New England Editor
Edward Allen Midwestern Editor
Francis J Kovalcik Middle Eastern Editor
David Rea Southeastern Editor
James G Plunkett Northeastern Editor
Charles F Hochgesang Western Editor
Archer E Knowlton Consulting Editor

News

Herbert R Frankel Managing News Editor
Jesse A Mock Assistant Managing News Editor
Rue M Shoop Associate Editor
Allen Long News Editor **Theodore W Fuller** and **Denise Hennessy** Editorial Assistants
Thomas R Jordan Commercial Editor
Kenneth N McLean Industrial Editor
George B Bryant, Jr Manager, Washington Bureau
V Craig Richter Washington Correspondent

Special Services

Arthur J Stegeman Manager, Market Research
Dexter M Keezer Director, Economics Department
Dora Merris Economist

Production

Kenneth K Kost Manager of Production
George Swift Assistant Manager of Production
Frank C Stockman Art Director
H Tomlinson Howland, Jr Production Editor
Elaine Maguire Assistant Production Editor

Advertising

Warren W Shew Sales Manager
District Managers: N V Palmer and E S Chapin, New York; E S Chapin, Boston; F P Coyle, Philadelphia; M S Kearney, Cleveland; M I O'Connell, Detroit; W H Meneilley and J T Schaefer, Chicago; J T Schaefer, St. Louis; E E Shirmer, Los Angeles; R C Alcorn and T H Carmody, San Francisco; Robert H Powell, Atlanta; Gordon Jones, Dallas.
Otto A Drechsell Business Manager
Donald K Ellis Promotion Manager

•

E Bryson Sessions Circulation Manager

. . . from the publisher

If you were editor, what would you put into the next issue?

We asked this quesiton of some of our subscribers last fall. Leaving ourselves open this way, we were gratified to find nearly all of them like the magazine as is. But a number of them came up with definite, helpful suggestions—some of which already have been incorporated.

For instance, many said they would put in a "capsule" page to summarize the issue's contents . . . a device to speed up digestion of information. You'll find it now in our Electrical Week department p. 20. Others asked for a regular section to cover nuclear developments. Our Atomic Progress department (p. 70) is now a weekly feature.

Naturally, their work had bearing on the type of material they would stress if editors. Top executives leaned towards articles on general economic conditions. Department heads wanted new equipment items plus the technical "meat" of design, construction, operation. Engineers and foremen like cost cutting ideas.

What would you do? We'll appreciate getting your ideas, too.

Fischer Black

ELECTRICAL WORLD

Published weekly by McGraw-Hill Publishing Co., Inc. James H. McGraw (1860-1948), Founder. **Executive, Editorial, Circulation, and Advertising Offices:** McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at 99-129 North Broadway, Albany 1, N. Y. See panel at right for directions regarding subscriptions or change of address.

Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator.

Subscriptions are solicited from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields; and from consulting engineers and electrical engineers in industry. **Position and company connection must be indicated on subscription orders.** Send to address shown in box at right.

United States and Canada subscription rate for individuals in the field of the publication $6.00 per year, single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

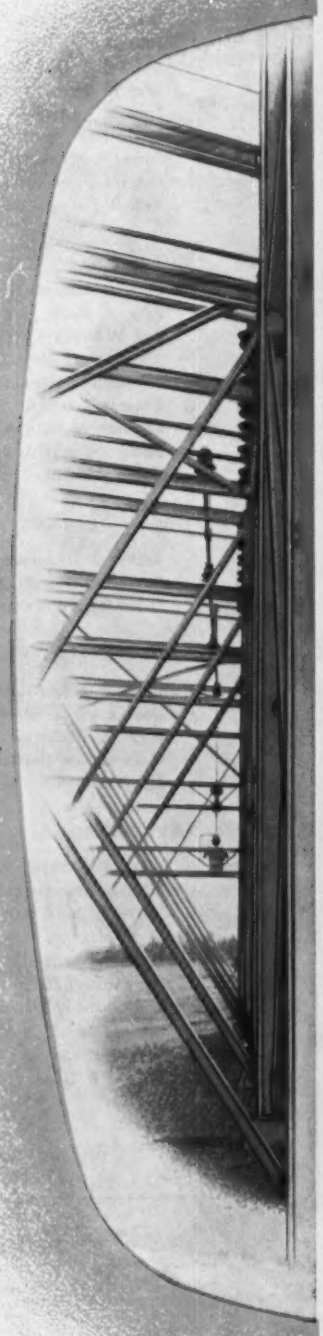
Second-class mail privileges authorized at Albany, N. Y. Printed in U.S.A.

Title registered in U.S. Patent Office. ©Copyright 1957 McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.

SUBSCRIPTIONS AND ADDRESS CHANGES: Send subscription correspondence and change of address to Subscription Manager, ELECTRICAL WORLD, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Subscription Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

Postmaster . . . Please send form 3579 to Electrical World, 330 W 42nd St., New York 36, N. Y.

An example of Allis-Chalmers

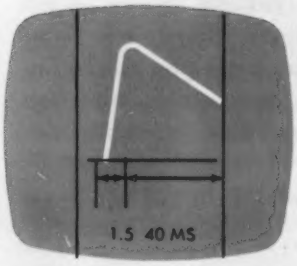


world's first 600,000-kva transformer bank

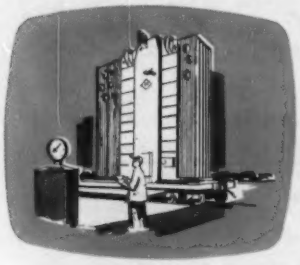
These three 200,000-kva, single-phase power transformers are now in service. Three duplicates are operating on the other end of a 345-kv transmission line.

Features of these transformers include:

- Corona-free design — prevents insulation damage due to corona. Testing included new switching surge test at 930,000 volts.
- Bank is rated 360,000 kva self-cooled, 480,000 kva with first set of fans, and 600,000 kva with a second set of fans.
- Lighter weight — Heavy plate aluminum in core and coil construction cuts shipping weight.



Tested for freedom from corona and switching surge capability



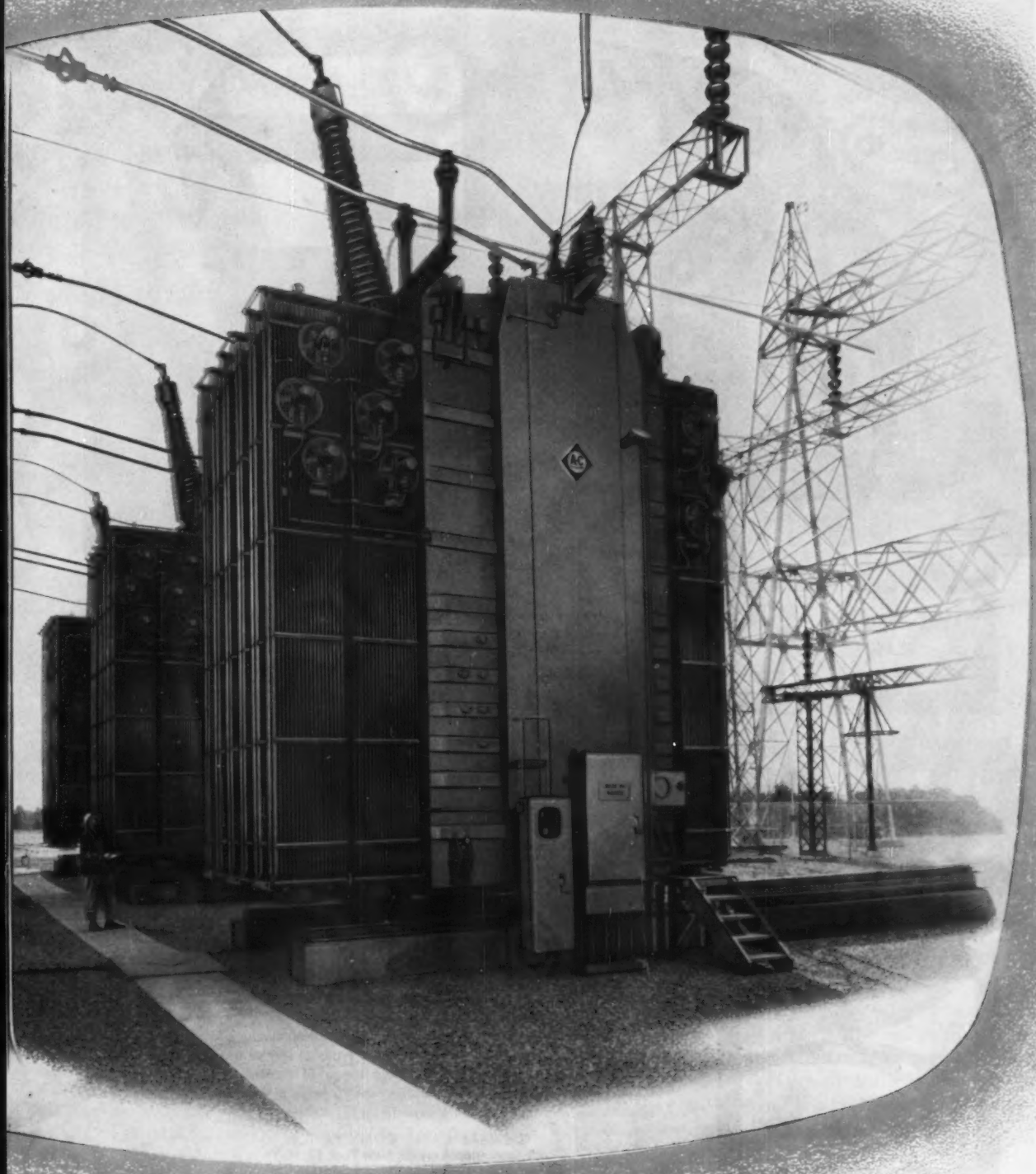
Use of aluminum cuts shipping weight

These units are examples of Allis-Chalmers leadership in helping power systems meet increased demands for power.

For information regarding latest transformer developments, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

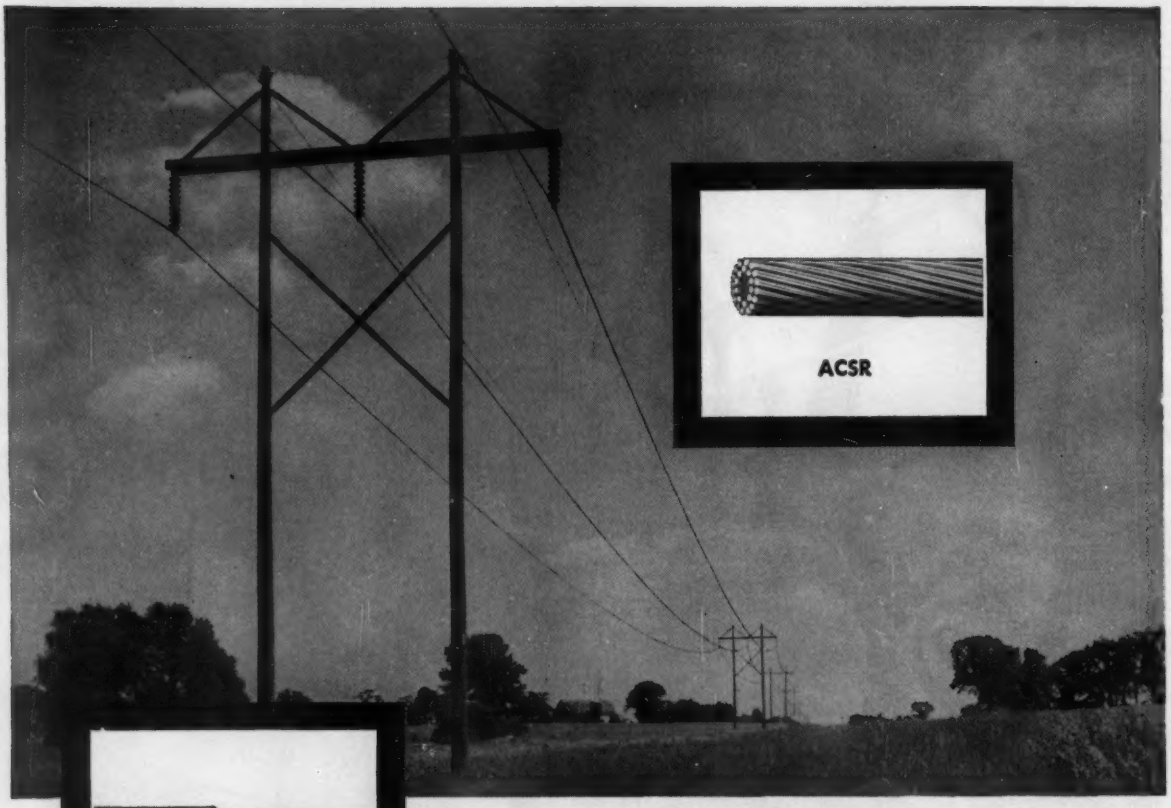
ALLIS-CHALMERS

leadership in transformers

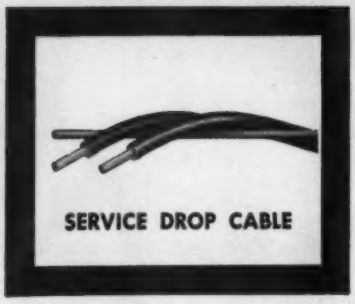


A-C
ALLIS-CHALMERS

A-5407



GENERAL CABLE
ALECTRAL
ALUMINUM
CONDUCTORS



Consistent, outstanding performance mark General Cable's ALECTRAL Bare and Insulated aluminum conductors. Manufactured to General Cable's high standards in all sizes. Bare ACSR and aluminum • Weatherproof aluminum and ACSR conductors • All types of service drop cables. ALECTRAL is available with a complete range of paper, rubber and thermoplastic insulations, backed up by over 75 years of General Cable's engineering and manufacturing experience.

GENERAL CABLE CORPORATION
420 Lexington Avenue, New York 17, N. Y.
Offices and Distribution Centers Coast-to-Coast

for quality and service . . . specify **GENERAL CABLE**

SHELL FORM
CORE FORM
Substation Transformer
100,000 KVA, 3 Phase
With load tap changing equipment. High Voltage: 330,000 Grd Y volts with ±10% regulation in 32 steps of ⅝%. Low Voltage: 14,400Δ volts.
Generating Station Transformer
48,000 KVA, 3 Phase
High Voltage: 115,000 Grd Y volts. Low Voltage: 13,200Δ volts.

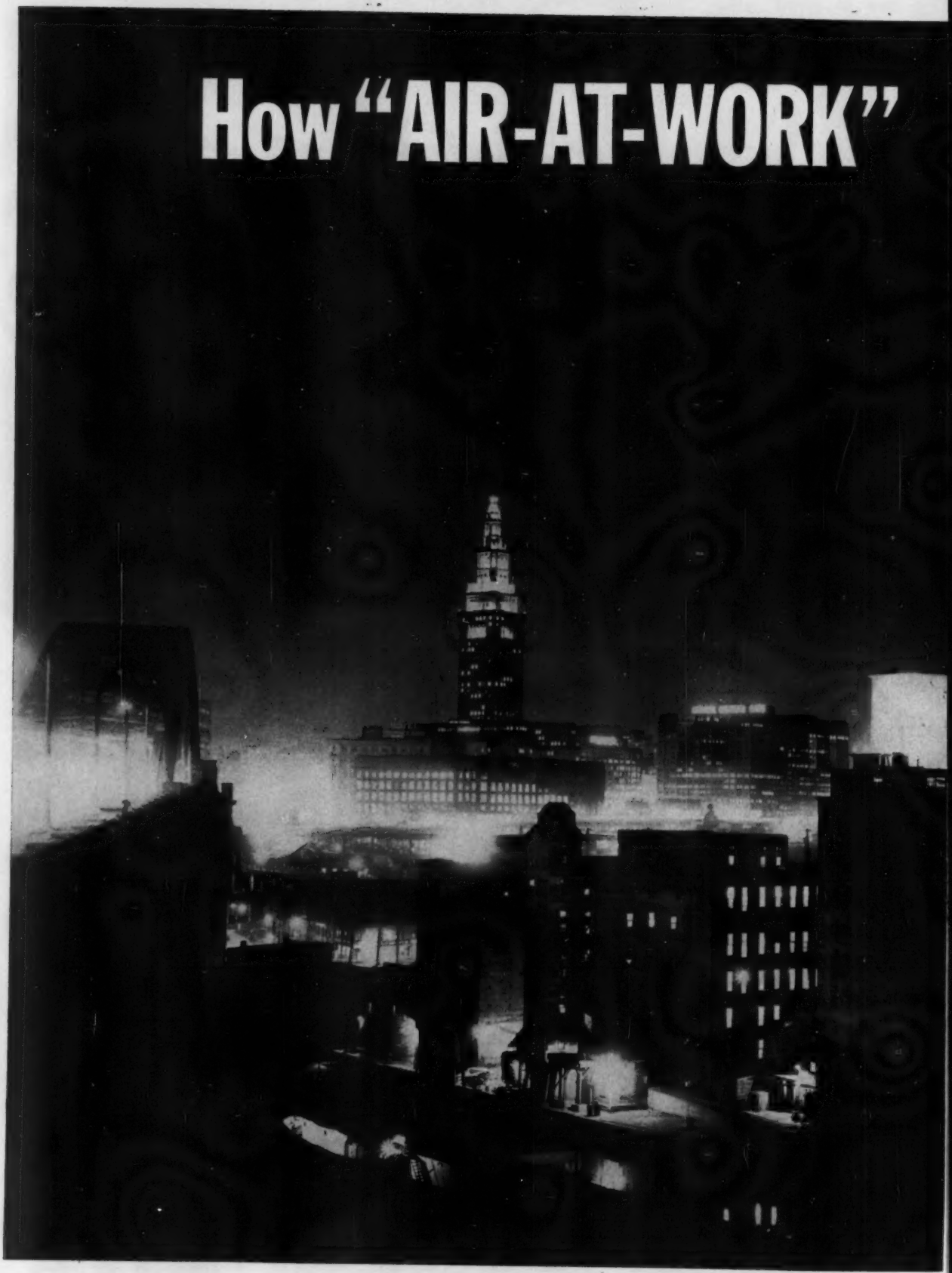
Pennsylvania builds *Both* types of Power Transformers for Generating Station and Substation Service

With wide experience in both shell form and core form design, Pennsylvania Transformer engineers are able to provide the transformer that is best suited to every application. Full consideration is given to size and weight, ease of installation, impedance, resistance to short circuit stresses, insulation strength, method of cooling, and other characteristics which result in definite advantages in a given kva and voltage for one design or the other. **Core form or shell form?** Why not let the answer for your next transformer be based on Pennsylvania's proved principles of power transformer design? Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

PENNSYLVANIA TRANSFORMERS

PENNSYLVANIA POWER TRANSFORMERS

How "AIR-AT-WORK"



Helps Light Cleveland

The Cleveland Electric Illuminating Company has used Westinghouse Mechanical Draft Equipment for Over 20 Years

At Cleveland Electric the job of providing combustion air for boilers is handled by Westinghouse Equipment. And in industrial plants, too, Westinghouse fans are often first choice.

The men who specify power plant equipment at leading utilities from coast to coast know that Westinghouse means top efficiency, unexcelled quality, ability to meet extremes of operating conditions—such as high volumes, high pressures, extremes of speed and temperature. Most important, they know that the Westinghouse name on air handling equipment is backed by more than 90 years' experience and leadership in design and manufacture.

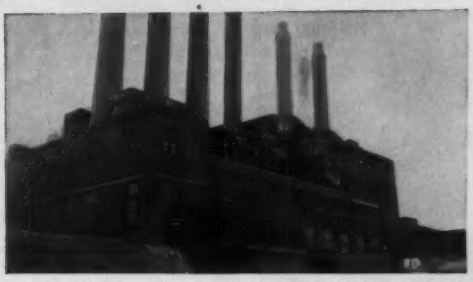
For complete application service, call your nearest Sturtevant Division Sales Engineer. Or write Westinghouse Electric Corporation, Dept. 22E, Hyde Park, Boston 26, Massachusetts.

WESTINGHOUSE AIR HANDLING

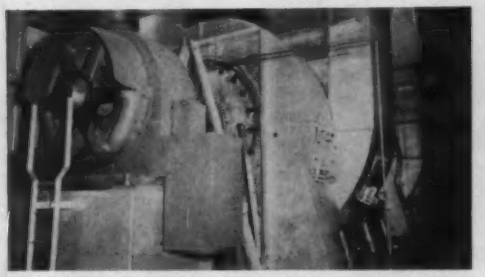
YOU CAN BE SURE... IF IT'S

Westinghouse

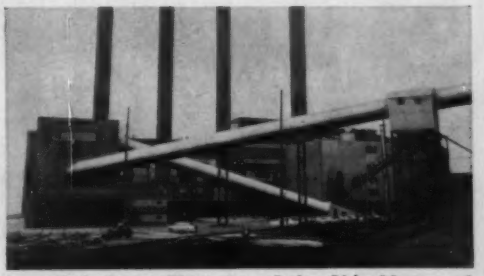
J-80594



Eastlake Power Plant, The Cleveland Electric Illuminating Company, using 16 Westinghouse Heavy Duty Forced and Induced Draft Fans to provide air for 660,000 KW maximum-output generators.

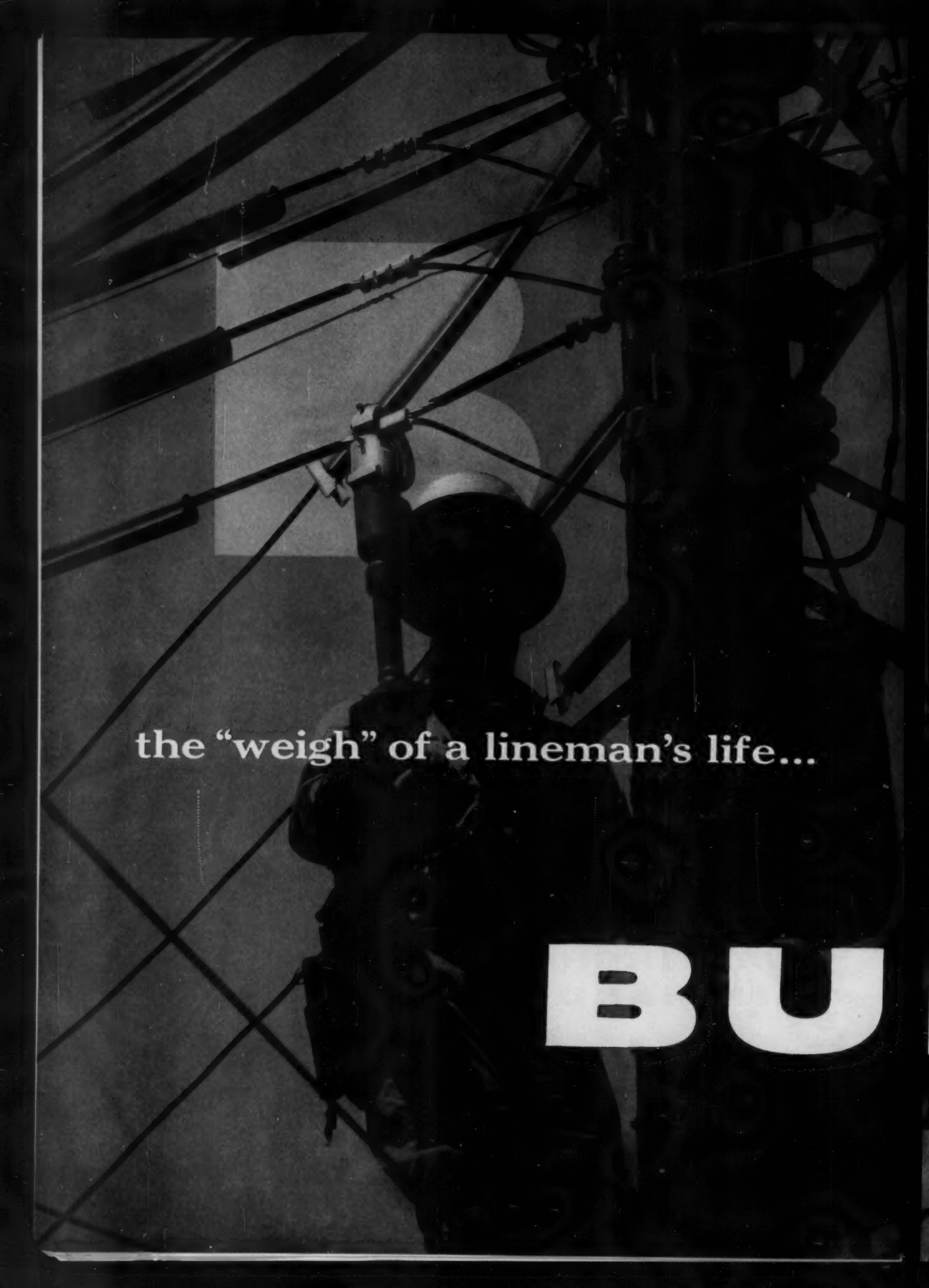


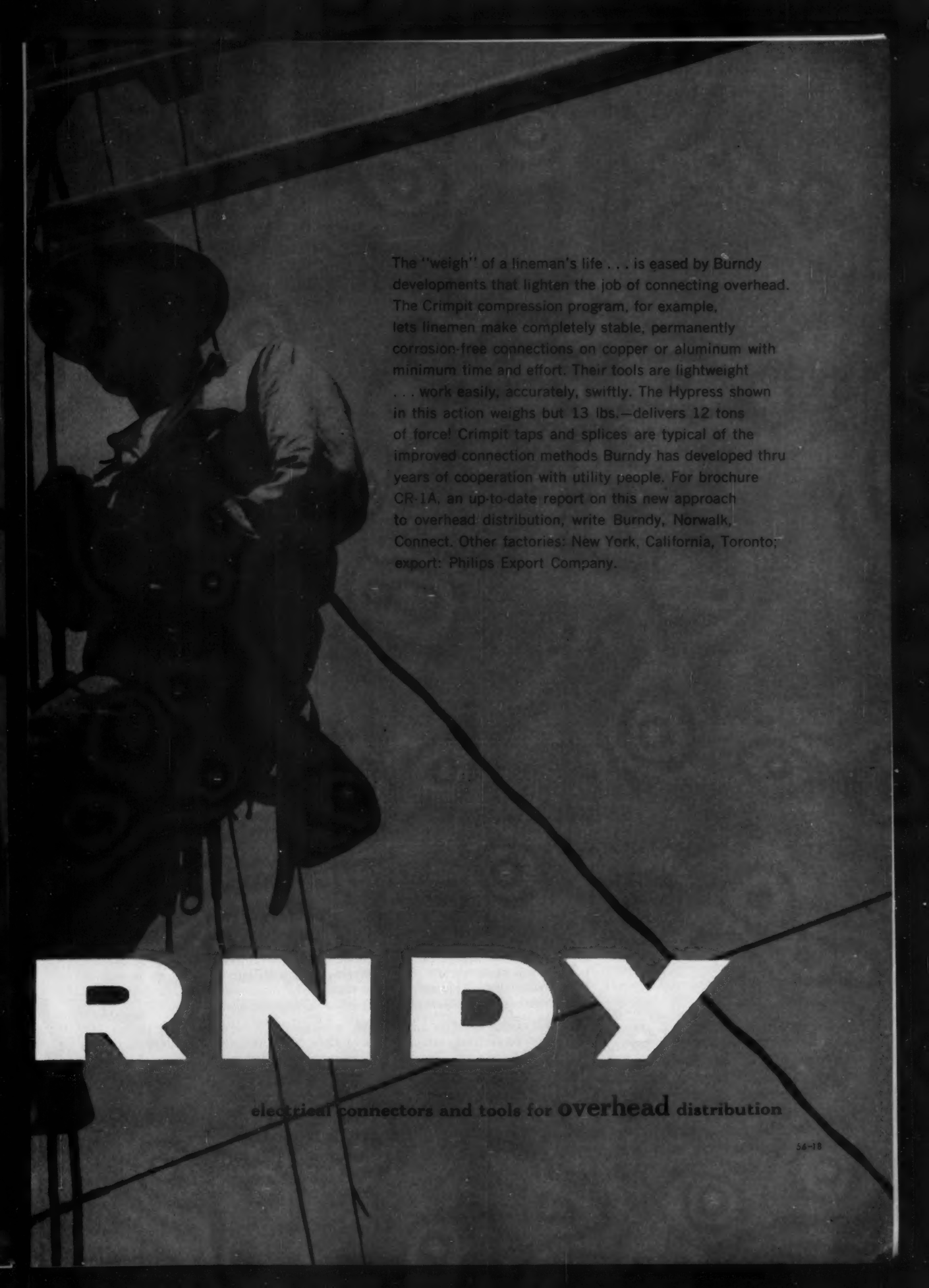
Air At Work — battery of Westinghouse Heavy Duty Induced Draft fans at Eastlake. The fan motors are Westinghouse, too.



Avon Lake Power Plant, Avon Lake, Ohio. Now rated at 420,000 KW capacity, current expansion program will boost output to maximum 670,000 KW, requiring 4 more Westinghouse fans for a total of 10 FD and ID units.

Inside Avon Lake Plant, these Westinghouse Heavy Duty Induced Draft Fans are typical of Westinghouse installations throughout the Cleveland Electric system.


the "weigh" of a lineman's life...
BU



The "weigh" of a lineman's life . . . is eased by Burndy developments that lighten the job of connecting overhead. The Crimpit compression program, for example, lets linemen make completely stable, permanently corrosion-free connections on copper or aluminum with minimum time and effort. Their tools are lightweight . . . work easily, accurately, swiftly. The Hypress shown in this action weighs but 13 lbs.—delivers 12 tons of force! Crimpit taps and splices are typical of the improved connection methods Burndy has developed thru years of cooperation with utility people. For brochure CR-1A, an up-to-date report on this new approach to overhead distribution, write Burndy, Norwalk, Connect. Other factories: New York, California, Toronto; export: Philips Export Company.

RNDY

electrical connectors and tools for **overhead** distribution

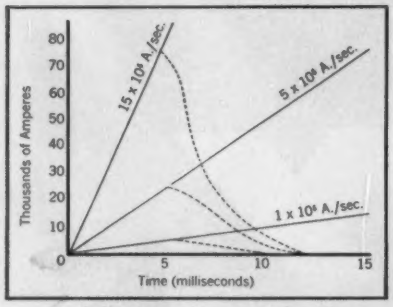
56-18

D-C CIRCUIT BREAKERS

Type FB-20 single pole circuit breaker; 2000 amperes continuous, 1000 volts d-c.

NEW "FB" CURRENT LIMITING CIRCUIT BREAKER

Now...complete current limiting protection against fault currents of 1000 to 150,000 amperes



Peak let-through current for FB circuit breaker with 1000 ampere trip.

Small in size, these FB d-c circuit breakers with fast current limiting action provide a tremendous protective capacity. In the event of a fault, powerful springs open the contacts before the current has a chance to rise to its maximum potential.

Even in circuits where the rate of rise might approach 15,000,000 amperes per second, let-through current will not exceed 80,000 amperes. In most applications, it will never exceed 30,000 amperes—and total interrupting time is only 12 milliseconds. This quick action reduces the magnitude and duration of fault currents—thus eliminating mechanical failures and heat damage.

FB circuit breakers are available in either single or double pole models and with continuous current ratings of 1200, 2000, 3000 and 5000 amperes and up to 1000 volts d-c. They are available with either stationary or drawout mounting. Write for Bulletin 3004-A. I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

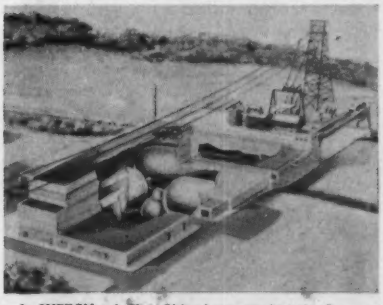
IN CANADA: EASTERN POWER DEVICES LTD.

Anaconda Arsenical Admiralty-439 Tubes being installed in the condenser at the Shippingport, Pa., Atomic Power Plant—25 miles northwest of Pittsburgh.

CONDENSER IN AMERICA'S FIRST BIG ATOM POWER PLANT USES 60 MILES OF ANACONDA ARSENICAL ADMIRALTY TUBE

The electric generating station at the Shippingport, Pa., Atomic Power Plant will add a maximum 100,000 kw of electric power capacity to Duquesne Light Company's system when it is placed in operation this year.

More significant, however, is its function of measuring the performance of the Pressurized-Water Reactor. It will help give some of the answers on how to "burn" uranium on a large scale and utilize the power economically, to guide design of future atomic power plants.



A SKETCH of the Shippingport Atomic Power Plant, cut away to show containment vessels housing the pressurized-water reactor and heat exchangers which generate steam to operate the turbine-generator. The condenser is located directly beneath the turbine-generator shown in the background.

The Westinghouse Turbine-generator has a minimum rating of 60 megawatts and a maximum of 100 megawatts. It operates on saturated steam at low pressure—987,350 lb/hr at a throttle pressure of 620 Psia, for 79.3 megawatt gross generator load. It is served by a 70,000-sq.-ft. Westinghouse condenser which provides a condenser vacuum of 1.5 in Hg Abs.

The condenser has a total of 10,276 Anaconda Arsenical Admiralty-439 tubes, 7/8" O.D. x 18 Stubs' gage x 30 ft. long, with a total weight of 153,676 lb. The tube plates of "true oval shape," 153" x 213" x 1½" thick, are of Leaded Muntz Metal, each weighing approximately 12,450 lb. These, too, were supplied by The American Brass Company.

Anaconda Arsenical Admiralty-439 has for years been an outstanding favorite for condensers and heat exchangers in power stations. Its arsenic content effectively inhibits dezincification under normal water conditions.

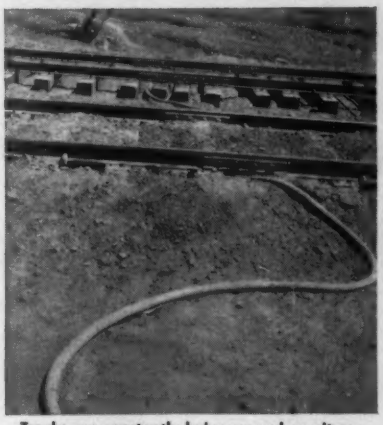
The American Brass Company laboratories are constantly studying corrosion problems to help make condensers and heat exchangers give longer and more dependable service—are leaders in the development of alloys to help meet the problems. Arsenical Admiralty is but one of its many contributions in the field.

TECHNICAL SERVICE. The Technical Department of The American Brass Company will be glad to help you select the one best alloy for the conditions you face. For such special service or for information on Anaconda Tubes and Plates, write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 8784

ANACONDA® TUBES AND PLATES FOR CONDENSERS AND HEAT EXCHANGERS

MADE BY THE AMERICAN BRASS COMPANY

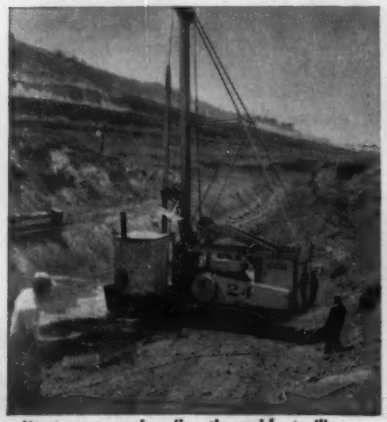
Over-all view of mine. Each ore car in foreground contains about 60 tons of ore.



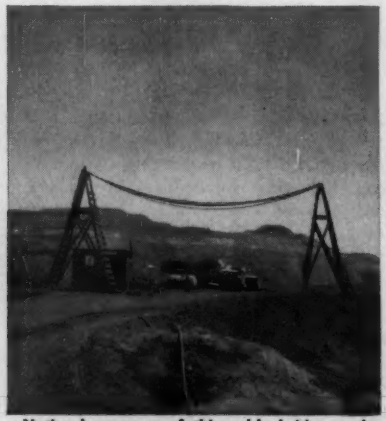
Tracks are constantly being moved as pit enlarges. Cables are moved with the tracks.

Cables lie in the sun or rain without any protection. They don't need any.

Shovel, being moved, carries 5000 feet of cable with it in the steel box.



Workman manhandles the cable trailing a churn drill as it heads for new location.



Notice long span of this cable bridge and extreme flexibility of cable in foreground.

Shovels lift up to 18 tons in one bite; they operate 24 hours a day.

Entrance poles and meter houses. Cables start from here, work at 440 or 4000 volts.

Iron ore mine finds Tiger Brand Amerclad *in use since 1928*

THE PICTURES show one of the greatest open pit iron ore mines in the world. From pole-head to meter house to shovels and drills, Tiger Brand Amerclad electrical cable serves as a flexible nerve system to supply the huge electrical requirements of machines that operate 24 hours a day in temperatures that range from 100° in the shade to minus 40° in the shoulder-deep snow.

Some of this cable has been in use since 1928, and it's still good.

Other cable is right in the blast area, where it is dragged over sharp rocks and pounded by dynamite-propelled boulders. Even this cable averages six to eight years of useful life.

Look at the pictures and read the captions that tell about operating conditions. You'll see why *no* heavy-duty electrical cable has a greater reputation than Tiger Brand Amerclad. Call your American Steel & Wire representative for the whole story.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS TIGER BRAND ELECTRICAL WIRE & CABLE

A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB

- asbestos wire and cable
- mold cured portable cord
- shovel & dredge cable
- paper & lead cable
- varnished cambric cable
- interlocked armor cable
- special purpose wire & cable
- aerial, underground and submarine cable

USS

UNITED STATES STEEL

question: why should this man wear safety glasses while using a Positect?

answer: the safety practices of this utility require safety glasses for all cutouts, even the Positect!

100-ampere Positect

The fused 100-ampere Positect can interrupt as much as 16,000 amperes, asym, and can switch any load it may be carrying—as much as 200 amperes with a 100-ampere link. Using a disconnect tube instead of a fuse tube converts the Positect into an enclosed load interrupter rated 300 amperes, both continuous and switching.

This utility knows that the lineman might close on a fault—and it uses safety glasses to protect him against such an eventuality. It uses the Positect because:

1. it is the only cutout which can be closed on a fault;
2. it directs the blast away from the operator—he is out of reach of the arc, flame, and shrapnel;
3. it minimizes the blast—by an exclusive feature which shortens the arc length;
4. the high inertia characteristic of its bayonet action opposes the recoil forces.

The long and short of it is this: it takes sound operating practices *and* good equipment to safeguard your linemen.

Specialists in High-Voltage Circuit Interruption Since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS • U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

NEWS-SCOPE

FUTURE NEWS ▶ **Electric Companies Advertising Program will be target** of two investigations now shaping up in Congress. As reported last week, Rep Earl Chudoff (D-Pa.) is looking for an opening to get into this probe. On the Senate side, Sen Estes Kefauver (D-Tenn.) is receiving reports from all state regulatory commissions on the manner in which utility advertising is charged for rate and tax purposes.

Planned capability additions for 1958 grow even bigger. EEI survey of last November showed planned additions of 15.9 million kw for 1958. Now plans are to add another 1 million kw to that figure—most of which has been deferred from current year.

Barge shipments of coal from Kentucky fields to Florida utility begin soon. West Kentucky Coal Co's newly christened tow boat, "Mark Eastin," will tow coal to Tampa Electric Co.

Another large nuclear power group is being formed.

LATE NEWS ▶ **Fierce tornado which struck Kansas City area** last week plunged several thousand homes in darkness, killed 37 persons, and injured scores more. All available crews of Kansas City P&L and Missouri Public Service worked through the night on hot lines felled by the twister. Utility damage estimates run upwards to $20 million, mostly in overhead transmission lines.

Congress unit begins probe of Arkansas P&L's proposed sale of electricity to Little Rock Air Force Base's 1,535-unit housing development. Arkansas Louisiana Gas opposes sale, contending gas heat rates are lower and wants Congress to cancel a $21.5-million contract with Miles Construction Corp. Miles had agreed to equip the houses with electric heat pumps. An AP&L spokesman contends Air Force and Defense Dept found electricity cheaper.

ODM Chief Gordon Gray refuses to tell Senate probers about talks with five top White House aides on quick tax write-offs for two Idaho Power dams. Gray claims his invoking of "executive privilege" does not mean he made write-off decision under instructions.

Massachusetts Senate votes against bills to appoint woman member and labor representative to Senate Public Utilities Commission.

A handbook of various technical information services available to access permit holders is now being prepared by the Atomic Energy Commission. AEC announced the action following a study to evaluate the effectiveness of the technical information services available.

Congratulations . . . C. Hazen Stetson rises from executive vice president to president of Maine Public Service . . . New vice president and assistant general manager at Minnesota P&L is Axel H. Herbert . . . Southwestern G&E named Robert F. Scott a vice president . . . P. M. Rutherford becomes vice president-commercial manager of Dallas P&L . . . Texas P&L ups T. D. Thomas to vice president.

EVENTS ▶ **Line contractors do $100-million-a-year business for utilities.** They are old timers on transmission construction, but they've made tremendous gains on distribution work since World War II (p 66) . . . Rural co-ops want to build a $45 million steam plant in Indiana to serve co-op and aluminum plant requirements (p 68) . . . Public Utilities Advertising Association hears pleas of TV and newspapers for more advertising, gets word on motivation studies (p 72).

GENERATION ▶ **Liquid cooled stator in a 290-Mva generator has proved successful** at Cleveland Electric Illuminating's Eastlake Plant. Using transil oil as a coolant, machine has been in satisfactory operation since March of last year. Transformer oil at velocities of flow that are practical in turbine-generators is said to have five times the heat removal ability of four atmospheres of hydrogen pressure. Heat removal ability of water is even more striking—around 12 times that of hydrogen. Now with the basic apparatus design conquered, look for trend to the use of liquid cooling in the large units (p 82).

Forced-air-cooled buses can take up to 10,000 amp, field tests on isolated phase bus indicate. The cooling system was developed and tested to overcome difficulties in handling high currents with conventional bus cooled by natural convection and radiation. Closed circuit cooling was used with air-water heat exchangers providing the means for heat dissipation (p 86).

Control room in the CEI Eastlake Plant should fulfill an operator's fondest wishes. The control boards are arranged in a segmented circular fashion with all panels facing the operator. From his desk the operator can look through glass doors into the turbine room and along a shelf beside the turbine room to the transformers and generator circuit breakers. In an opposite direction he can look across the forebay to the transmission substation. It's a real showplace (p 87).

TRANSMISSION ▶ **Transmission line faults can be located handily** with the surplus range calibrator which Utah P&L has coordinated with its standard radar-type fault locator. It monitors line in 4-mi segments (p 88).

DISTRIBUTION ▶ **Here's real short cut for determining the need for secondary capacitors** on 3-phase transformer banks. Florida P&L engineers have worked out a relatively simple formula for the analysis, and they now use a tabular form for collecting the required data. E. L. Bivans and V. B. Nolan tell how they have cut engineering time by 85% in performing these analyses. Copies of the forms and a 1-2-3 step method for analyzing the need for capacitors on either new or existing, open or closed Wye-Delta banks are reproduced in the article (p 78).

Truck-mounted, insulated electro-hydraulic ladder enables a single crew to replace some 5 to 18 old street lights with new, carefully

positioned luminaires each day. Rig is used at Portland General Electric (p 90).

Templates for positioning the anchor bolts and transite duct ells for heavy street light standards were devised and made by Indianapolis P&L (p 94).

Hydraulic brake, salvaged from low-priced car, is used on wire reel buggy to control tension accurately in the stringing of distribution lines. It saves muscle power and adds safety factors, reports Gulf States Utilities (p 94).

HEATING & COOLING ▶ **Two complete, independent electric heating systems** have been installed in an all-electric home by Narragansett Electric Co to help gather data on the possibility of electric heating in the utility's service area . . . Five heat pumps help air condition the offices in the Jefferson Memorial in Washington (p 100).

SELLING ▶ **Now they're using electricity to reduce alkali content,** improve permeability of soil in Arizona. It has apparently upped yield of lettuce in 10-acre test field . . . NEMA group boosts rural water systems for farm homes at recent conference (p 99).

MANAGEMENT ▶ **Electric utilities offered $60 million in new issues last week—$30** million in bonds and $30 million in stocks—for another heavy week . . . Wall Street is watching for trend toward non-callable clauses in new bond issues. New York State Electric & Gas put a 5-year, non-callable clause in recent bond sale (pp 127, 128).

PEOPLE ▶ **At New England G&E Association Floyd D. Campbell is elected president** and chief executive officer. At Houston Lighting & Power J. F. Estill, Jr, is new vice president (p 136).

MANUFACTURERS ▶ **New line of "preferred design" power transformers** can be built in any rating from 5,000 to 50,000 kva and delivered 6 to 12 weeks quicker than non-preferred designs. Creation of this line followed a survey to determine the preferences of utilities in power transformer design . . . Ridgeway Division of the Elliott Co has won contracts over foreign competition for two 42,105-kva, 128.6-rpm vertical hydraulic turbine-driven generators (pp 133, 134).

NEW EQUIPMENT ▶ **New line of small, light weight, 60-cps single-phase distribution transformers** for pole mounting is available for both urban and rural use in variety of sizes . . . Ten-ft aluminum tapered, elliptical street lighting bracket requires small area of mounting space, is reported to withstand 100-mph wind loadings . . . Parallel groove clamps are prefilled with Contax oxide inhibiting compound. Clamps accomodate in either groove the popular range of conductors No. 6 AWG to 1/0 ACSR as well as other sizes and combinations of sizes (p 109).

ENGINEERING TRENDS

First step in relay standardization may be the physical sizes and locations of terminals and mounting studs for each type of relay. Continued study of system needs may suggest standard ranges and characteristics to cut the number of relays in each type.

Adequate cooling water is vital for nuclear power plants because the relatively low steam conditions proposed for them will raise steam flow to the condenser up to 50% above that of most conventional steam-electric plants.

Insect enemies of utility field personnel will be frustrated by diethyl toluamide, according to the U. S. Dept of Agriculture. Tests prove this new weapon highly effective against ticks, chigger mites, and rat fleas as well as flies and mosquitoes.

Closer regulation of gas pressure in power transformers appears in the offing as a means to cut nitrogen absorption in insulating oil during load cycles. Nitrogen "pumped" into the oil during such periods is released as bubbles during subsequent light-load periods to cut insulation strength of oil and insulating structures of transformers.

Age does not impair the short-circuit capability of air-break switches, according to tests by an Eastern utility. Outward appearance is not a criterion, either, but lack of maintenance can curtail both the short-circuit and continuous-current capabilities.

Permeability of core samples is tested with radio frequencies in a new permeameter developed by National Bureau of Standards. Samples are fabricated in toroidal shape to avoid end corrections and tested in a uniform current sheet from below 20 kc to over 50 Mc. Test temperature can be ambient or raised by an oven enclosing the sample.

FROM EDITORS IN THE FIELD

Standardized substation design cuts construction manhours 50% or more for Central Maine Power Co. Repetitive designs for steel structures save $60 to $65 per ton in drafting, fabrication, and templates for erection.

Microwave fading on critical 20-30-mile links can be overcome by dual transmission with frequencies spaced in 4 or 5-to-1 ratio. Atmospheric conditions which cause the fading do not cancel different frequencies at the same time.

Slow-scan TV for energy telemetering of a major interconnection is planned by Idaho Power Co. The signal will be transmitted about 170 mi over a normal voice channel of its microwave system. This basic method is proposed also for television viewing of switchboard indicators at Oxbow powerplant to facilitate supervisory control from Brownlee.

FREE...

New 24-Page Treatise on Instrument Transformers

Available to Schools and Training Classes

UTILITY metering superintendents, industrial electrical engineers, switchboard builders — here's a desk-mate you will consult often and profitably. Instructors in engineering schools and on-the-job training programs — you will want to use this informative bulletin as a textbook. It's the most complete treatise ever compiled on the theory and operation of instrument transformers.

Included are comprehensive data presented in handy reference form, typical performance curves and a handy ratio-phase angle correction chart.

Single or quantity copies are yours for the asking. Write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Allis-Chalmers Instrument Transformers Available in Over 400 Ratings

Name the application. There's an Allis-Chalmers instrument transformer that fills the bill precisely. Indoor, outdoor, dry-type, oil or compound-filled units — they are all available in the widest possible rating range.

ALLIS-CHALMERS

A-5386

ENGINEERING TRENDS

First step in relay standardization may be the physical sizes and locations of terminals and mounting studs for each type of relay. Continued study of system needs may suggest standard ranges and characteristics to cut the number of relays in each type.

Adequate cooling water is vital for nuclear power plants because the relatively low steam conditions proposed for them will raise steam flow to the condenser up to 50% above that of most conventional steam-electric plants.

Insect enemies of utility field personnel will be frustrated by diethyl toluamide, according to the U. S. Dept of Agriculture. Tests prove this new weapon highly effective against ticks, chigger mites, and rat fleas as well as flies and mosquitoes.

Closer regulation of gas pressure in power transformers appears in the offing as a means to cut nitrogen absorption in insulating oil during load cycles. Nitrogen "pumped" into the oil during such periods is released as bubbles during subsequent light-load periods to cut insulation strength of oil and insulating structures of transformers.

Age does not impair the short-circuit capability of air-break switches, according to tests by an Eastern utility. Outward appearance is not a criterion, either, but lack of maintenance can curtail both the short-circuit and continuous-current capabilities.

Permeability of core samples is tested with radio frequencies in a new permeameter developed by National Bureau of Standards. Samples are fabricated in toroidal shape to avoid end corrections and tested in a uniform current sheet from below 20 kc to over 50 Mc. Test temperature can be ambient or raised by an oven enclosing the sample.

FROM EDITORS IN THE FIELD

Standardized substation design cuts construction manhours 50% or more for Central Maine Power Co. Repetitive designs for steel structures save $60 to $65 per ton in drafting, fabrication, and templates for erection.

Microwave fading on critical 20-30-mile links can be overcome by dual transmission with frequencies spaced in 4 or 5-to-1 ratio. Atmospheric conditions which cause the fading do not cancel different frequencies at the same time.

Slow-scan TV for energy telemetering of a major interconnection is planned by Idaho Power Co. The signal will be transmitted about 170 mi over a normal voice channel of its microwave system. This basic method is proposed also for television viewing of switchboard indicators at Oxbow powerplant to facilitate supervisory control from Brownlee.

FREE...

New 24-Page Treatise on Instrument Transformers

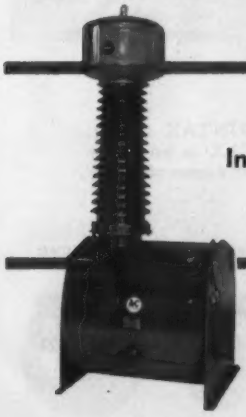
INSTRUMENT TRANSFORMERS
Theory and Operation
CONTENTS
Function . . . . . Page 2
Types 2
Polarity Marking 2
Coordination of Insulation 3
Impulse Protection 3
Accuracy 5
Performance Curves 6
Potential Transformers 9
Current Transformers 14
Ratio-Phase Angle Correction Chart 21
Corrections and Overall Accuracy 22
Factory Tests 22
ALLIS-CHALMERS

Available to Schools and Training Classes

UTILITY metering superintendents, industrial electrical engineers, switchboard builders — here's a desk-mate you will consult often and profitably. Instructors in engineering schools and on-the-job training programs — you will want to use this informative bulletin as a textbook. It's the most complete treatise ever compiled on the theory and operation of instrument transformers.

Included are comprehensive data presented in handy reference form, typical performance curves and a handy ratio-phase angle correction chart.

Single or quantity copies are yours for the asking. Write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



Allis-Chalmers Instrument Transformers Available in Over 400 Ratings

Name the application. There's an Allis-Chalmers instrument transformer that fills the bill precisely. Indoor, outdoor, dry-type, oil or compound-filled units — they are all available in the widest possible rating range.

ALLIS-CHALMERS

A-5386

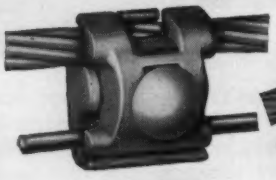
Reduce Inventory!

USE BLACKBURN'S PermaCad Aluminum Fittings

CHECK THESE PLUS FEATURES

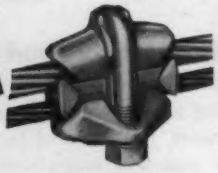
- All fittings may be used on either aluminum or copper conductors. Each fitting accommodates a wide range of wire sizes—few fittings are needed in stock or on trucks.
- Installation errors are eliminated on bi-metallic connections. Either groove will accommodate aluminum or copper conductors.
- Permacad fittings are available in one or two bolt parallel groove clamps—single and double U-bolt clamps. There's a fitting for every job.
- Grooves are contoured to surround conductor and provide large contact areas . . . improving conductivity.
- Non-copper-bearing, heat treated aluminum alloys used in all castings. Hardware available in either hot dipped galvanized steel or high strength aluminum alloy. Bolts alumilited to prevent seizing.

* **PERMACAD** *is a complex, heavy duty plating of cadmium and other metals which has exceptionally long life. PERMACAD protects aluminum because of its favorable electrogalvanic potential and is highly resistant to galvanic corrosion when in contact with copper.*

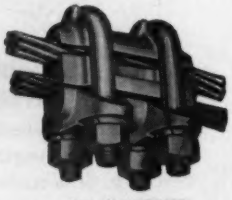


PGP SERIES
One bolt parallel groove clamp. Three fittings accommodate wire ranges from 8 AWG to 397.5 MCM.

PGP 400 SERIES
Two bolt parallel groove clamp. One clamp accommodates conductors from 1 str to 400 MCM.



DLC GP SERIES
Single U-bolt clamp. Four clamps accommodate wire range from 6 AWG to 266.8 MCM.



2U GP SERIES
Double U-bolt clamp. Six clamps accommodate conductors from 1 str to 397.5 MCM.

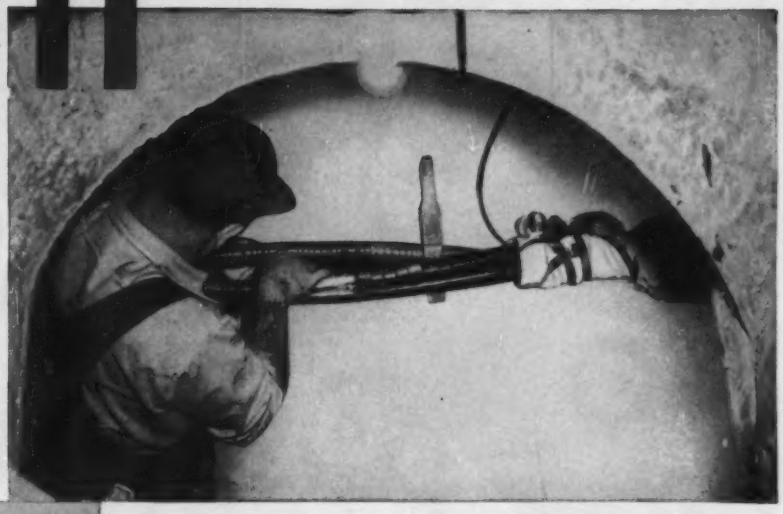
BLACKBURN PermaCad FITTINGS

IMPORTANT: We recommend the use of CONTAX on all aluminum and bi-metallic connections. CONTAX is an oxide inhibiting compound with an ASTM drop point in excess of 500° F.

AVAILABLE THROUGH ELECTRICAL DISTRIBUTORS EVERYWHERE

JASPER BLACKBURN CORPORATION
35 MADISON ST. • ST. LOUIS 6, MO. • PHONE MAIN 1-2821

TAPE IT for durability with



USKORONA SPLICING COMPOUND
US
RUBBER
½ IN. WIDE
30 FT. ROLL
OZONE & MOISTURE
RESISTING COMPOUND
Uskorona combines maximum resistance to OZONE and MOISTURE with high tensile strength, elongation and dielectric resistance. Fuses quickly without heat or pressure and makes PERFECT SPLICES.
MADE IN U.S.A.
United States Rubber Company
USKORONA SPLICING COMPOUND

USKORONA

the only tape that resists both moisture and ozone

Uskorona tape will *not* break down. Just how rugged is this tape? Well, in a corona-(ozone) resistance test of 4 leading brands, Uskorona was the only tape still intact after 4 hours of exposure. All others broke down. Even after 1500 additional and *consecutive* hours of exposure, Uskorona remained as fresh and corona-resistant as at the start.

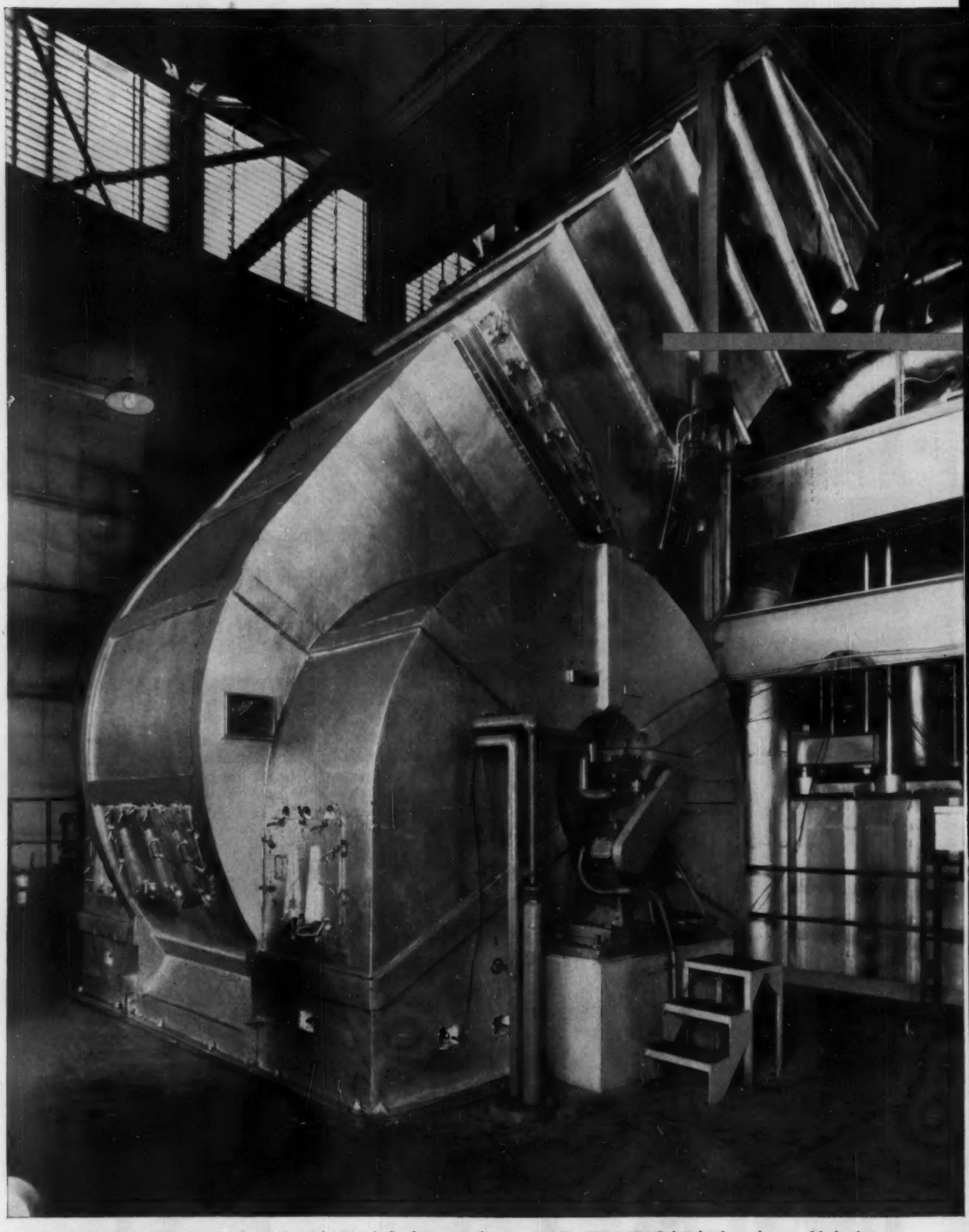
Electrical engineers insist on Uskorona in the design, installation, operation and maintenance of power lines wherever corona or moisture is a problem. Uskorona provides ideal insulation in splicing electrical cables on underground power lines, on secondary network systems, underground street lighting circuits, and transformer leads. It fuses with and becomes a part of the insulation and gives the *same* dielectric strength as the original insulation. Exceeds A. S. T. M. specifications.

Uskorona® is obtainable at any of our selected distributors, any of the 27 "U. S." District Sales Offices, or contact us at Rockefeller Center, New York 20, N. Y.

US RUBBER

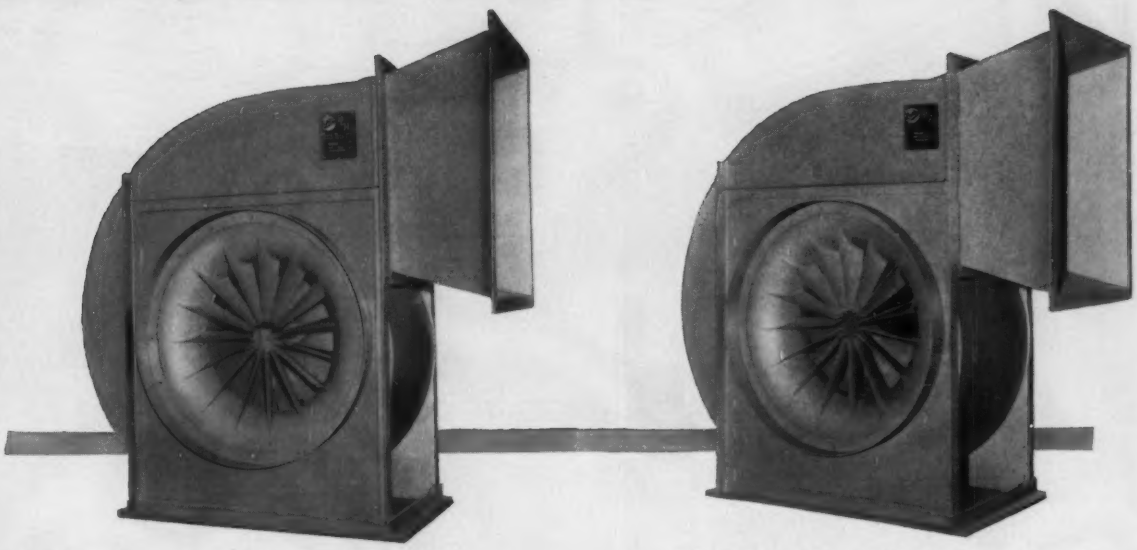
Mechanical Goods Division

United States Rubber



"BUFFALO" DOUBLE-WIDTH I.D. FAN *in station of one of the largest utility companies. Here, "Buffalo" backward-curve blade design provided the desired balance of high efficiency and long life over the range of boiler loads.*

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT



The "Buffalo" Type "BLH" Fan—broad performance characteristics—86% mechanical efficiency.

The "Buffalo" Type "BA" Airfoil Fan — mechanical efficiencies up to 92%.

TO MATCH YOUR HORSEPOWER EVALUATION EXACTLY-

a complete series of "Buffalo" I.D. fans

Today's steam generation requirements are so varied and critical that no single type of mechanical draft fan can cover them all to best advantage. However, thanks to the complete "Buffalo" *series* of Fans, you can match fan characteristics to your requirements very closely.

Suppose maximum **efficiency at specific operating conditions is the major consideration.** The "Buffalo" Airfoil Fan, with mechanical efficiency up to 92%, would be the ideal choice, with 3 airfoil wheels and 3 semi-airfoil wheels available for best performance against the pressure of your particular system and load range. And dampered performance of the "Buffalo" Airfoil Fan is excellent, thanks to properly shaped and streamlined "Buffalo" Variable Inlet Vanes.

For systems where high efficiency over a broad operating range is of major importance, "Buffalo" Type "BLH" Fans offer stable performance and mechanical efficiency above 80% from 70% to 135% of rated volume. The "BLH" will operate at practically identical efficiency with either fixed or variable inlet vanes, for accurate volume without sacrificing fan performance.

Or where abrasive conditions exist, and where high-pressure, high-capacity characteristics could mean selection of a smaller (and lower-cost) fan, the "Buffalo" Type "CR" Radial Blade design merits your consideration. Besides inherent resistance to wear, it offers 76% static efficiency — plus a choice of three wheels for best performance under your pressures.

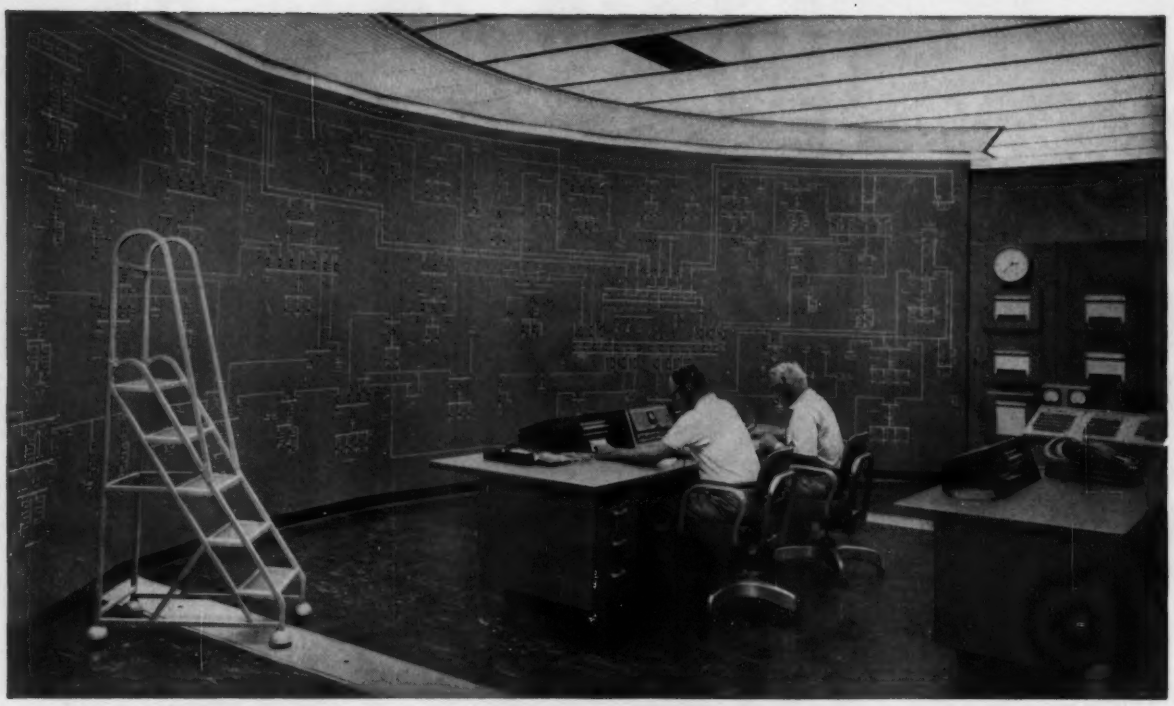
Write for Bulletins F-200, FD-205 and FD-106 for the one *complete* selection of Mechanical Draft Fans — "Buffalo" — known for the "Q" Factor, or *built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY

BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING



New Jersey Power and Light Reports

GENERAL ELECTRIC PROGRESS LINE TWO-WAY RADIO PROVIDES MAXIMUM COVERAGE

New Progress Line Units Are Assigned Exclusively to Long-range Duty

After replacing many of its 100 mobile radio units with new General Electric Progress Line units, New Jersey Power & Light Company learned that the new G-E units perform so well that they are now assigned to the trucks that operate farthest from their base stations.

Get Greater Range and Better Reception

In addition to the excellent range of operation provided by the new General Electric units, Harold Mann, communications engineer, is enthusiastic about the high-fidelity quality of messages from mobile units. This, he explained, is due largely to the controlled reluctance microphones supplied with all Progress Line mobile units.

The utility's radio system includes 10 base stations throughout the northern half of New Jersey, 5 of which have 450-mc repeaters, and 100 low band 60-watt mobile units.

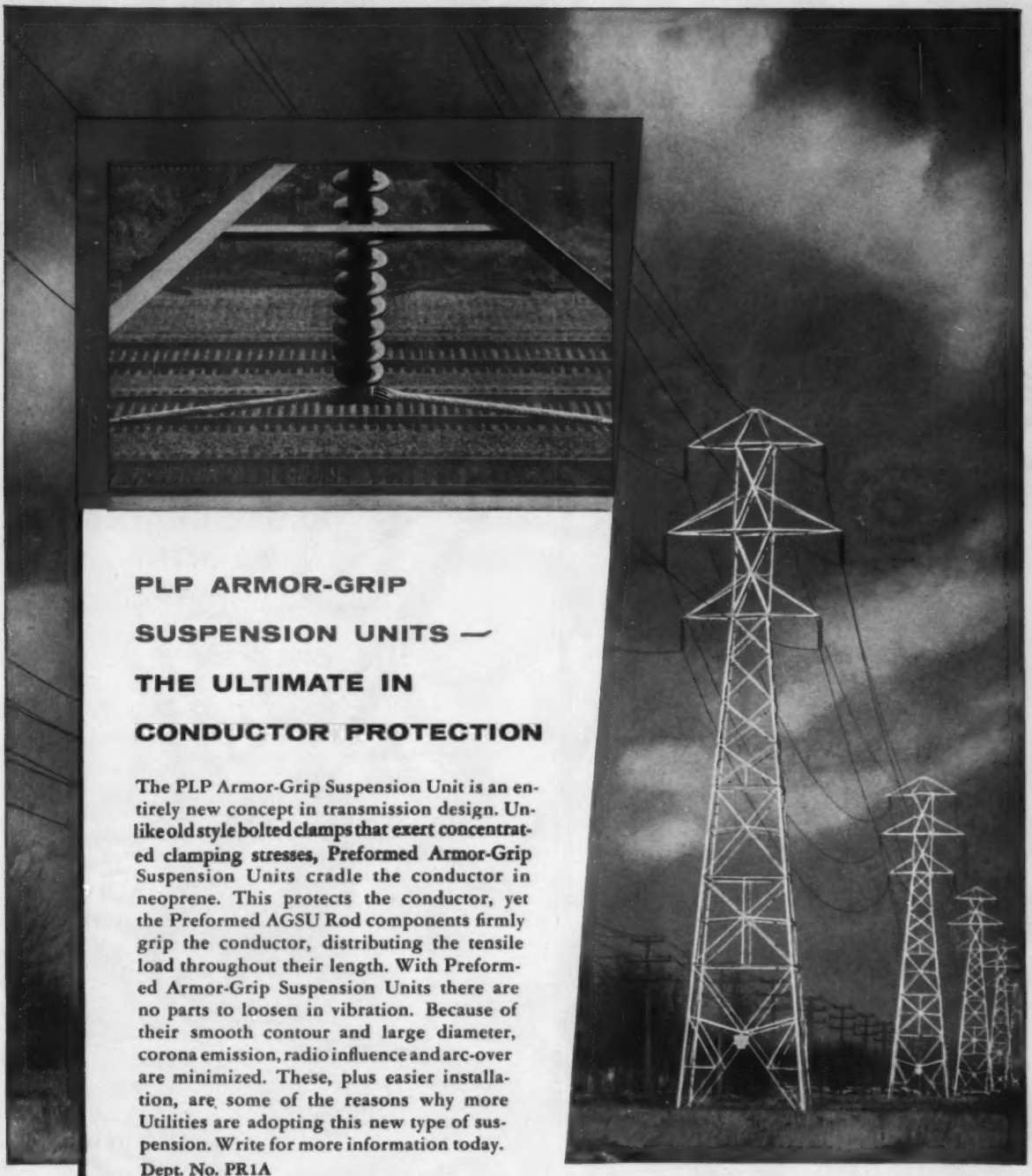
Maintenance of all New Jersey Power & Light Co. radio equipment is provided by the Warner Engineering Company, an authorized General Electric Service Station located in Upper Montclair, N. J.

The utility reports that its 10-year experience with radio has proven a maintenance contract with the General Electric Service Station is more economical than providing service through its own maintenance department, and is equally effective.

For Sales and Service...see "Radio Communication Equipment" in your yellow pages. Or, write: General Electric Company, Communication Equipment, Section C2257-27, Electronics Park, Syracuse, New York. *In Canada:* C.G.E. Electronics, 830 Lansdowne Avenue, Toronto.

Progress Is Our Most Important Product

GENERAL ELECTRIC



PLP ARMOR-GRIP SUSPENSION UNITS — THE ULTIMATE IN CONDUCTOR PROTECTION

The PLP Armor-Grip Suspension Unit is an entirely new concept in transmission design. Unlike old style bolted clamps that exert concentrated clamping stresses, Preformed Armor-Grip Suspension Units cradle the conductor in neoprene. This protects the conductor, yet the Preformed AGSU Rod components firmly grip the conductor, distributing the tensile load throughout their length. With Preformed Armor-Grip Suspension Units there are no parts to loosen in vibration. Because of their smooth contour and large diameter, corona emission, radio influence and arc-over are minimized. These, plus easier installation, are some of the reasons why more Utilities are adopting this new type of suspension. Write for more information today.

Dept. No. PR1A

PX-79

PLP Armor-Grip Suspension Units support these 132 KV Cleveland Electric Illuminating Company lines.

PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

Telephone: Cleveland EXpress 1-3571

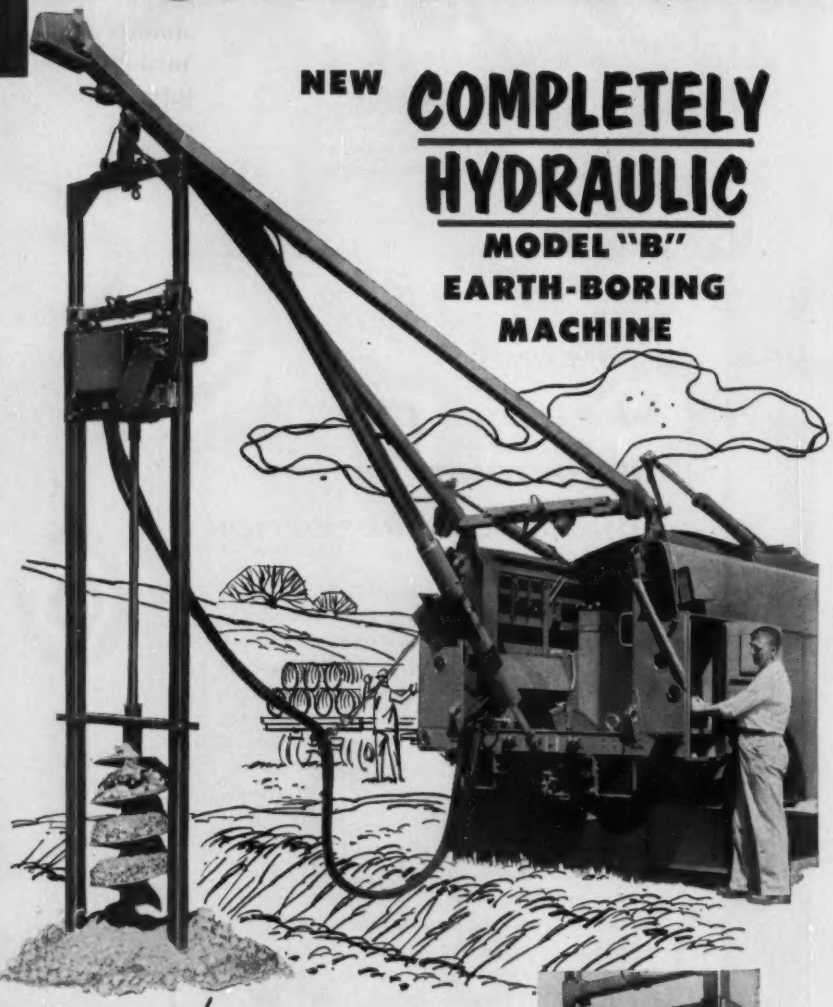
Made in accordance with or for use under one or more of the following U. S. Patents: 2,722,393; 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending

HIGHWAY

Digs holes 11 to 22 inches in diameter, up to 7 feet at any angle up to 90°... *all hydraulically*

Here is your answer for easy, safe, convenient digging. A pressure feed hydraulic digger with "fingertip" remote hydraulic controls — that digs rapidly in every type of soil including frost and hard pan. The swivel-mounted digger pivots to dig anchor holes and is operated from the rear of the truck in a convenient standing position. This rugged, suspended-type digger has a "reaching" capacity for hard-to-get-at areas — fits on roof of truck, does not take valuable truck room. With the Model "B" digger in position, the derrick is free for any pole-setting operation. The Model "B" digger can be rear- or front-mounted on any type line maintenance body, with any type hydraulic derrick. This unit is time-tested to insure trouble-free operation.

NEW **COMPLETELY HYDRAULIC**
MODEL "B" EARTH-BORING MACHINE



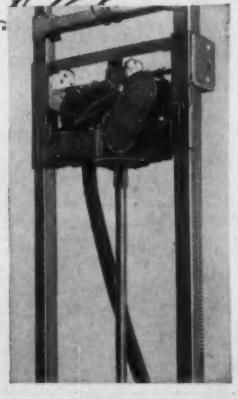
HIGHWAY

A Division of Merritt-Chapman & Scott Corp.

Exclusive! **CHAIN CROWD ASSEMBLY AND "HOLE SIZER"**

Actuated Chain Crowd Assembly assures rapid and smooth downward digging action. The flight auger featuring the "hole sizer" blade cuts a trim hole to diameter desired.

Write for information and specifications



UTILITY DIVISION
HIGHWAY TRAILER COMPANY
HEADQUARTERS: EDGERTON, WISCONSIN

Manufacturers of: Public Utility Bodies • Earth-Boring Machines • Pole and Cable Reel Trailers • Winches • Power Take-offs • Service Accessories • Commercial Trailers • Trailerized Tanks and Dry Bulk Haulers

SALES AND SERVICE IN PRINCIPAL CITIES

Your Westinghouse representative can prove...

NEW TRANSFORMER DESIGN ELIMINATES 18 SOURCES OF CORROSION

Dome cover with new eye-bolt I-beam construction plus new internally mounted H. V. and L. V. bushings eliminate corrosive hardware. Patented "Coastal Finish" – toughest, stubbornest protection you can buy – makes these transformers corrosion-proof.

J-70794

YOU CAN BE SURE... IF IT'S

Westinghouse

Sam Waters, Westinghouse representative, demonstrates to Jack Evans, General Purchasing Agent, Ohio Edison, the volume of corrosive hardware removed from new line of Westinghouse transformers.

"Magic Touch"

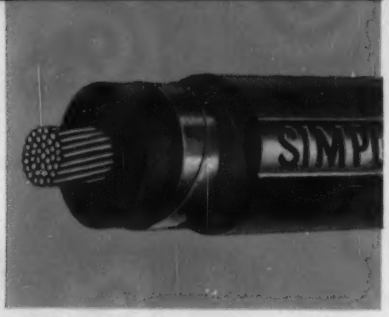
Lights burn and wheels turn when the magic of electricity surges through industry's life line of high voltage cable. Long, intensive testing has proved beyond question that Simplex ANHYDREX XX insulated cable possesses the stability and resistance that assure long, trouble-free service in all environments. Its amazing resistance to ozone and other oxidizing agents make Simplex ANHYDREX XX the logical choice for your high voltage applications. For complete technical data write for Booklet 1023.

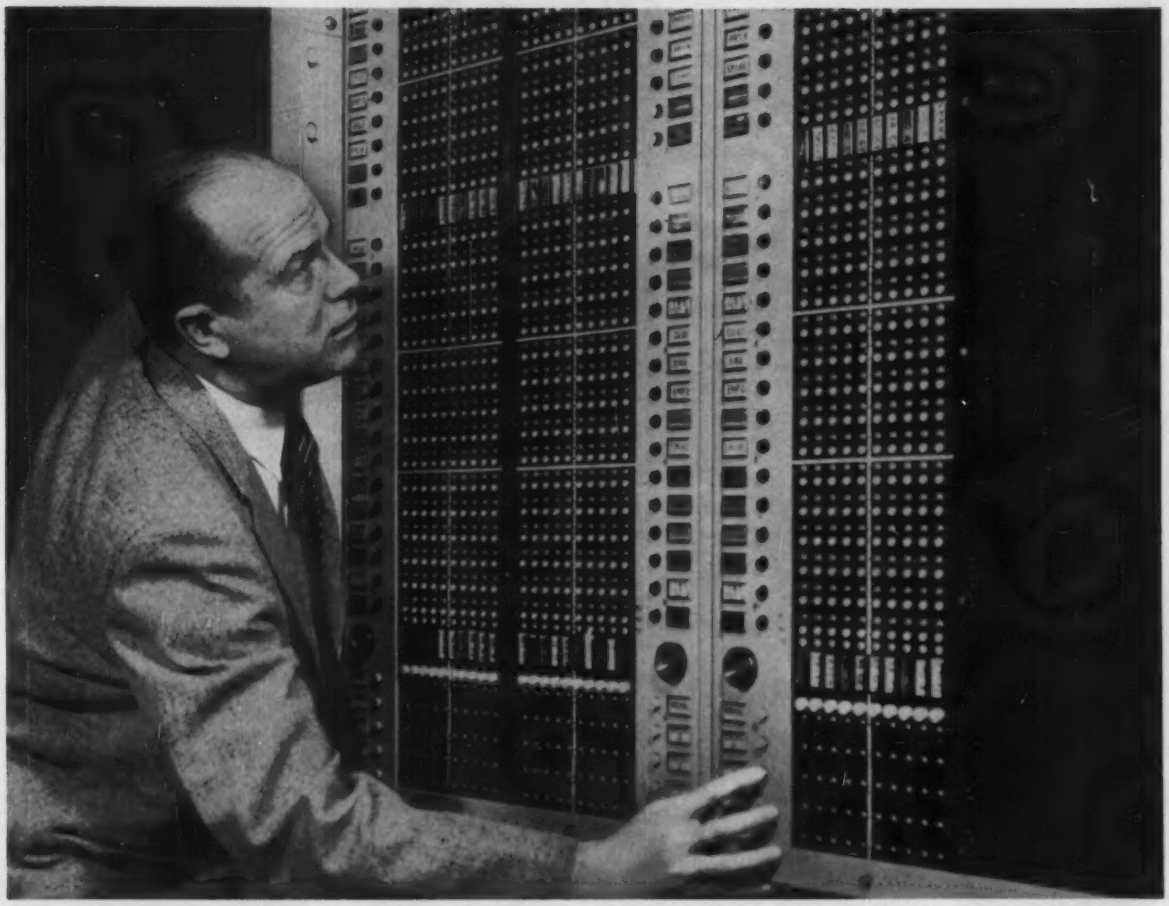
SIMPLEX WIRE & CABLE CO.,
79 Sidney Street, Cambridge 39, Mass.

LIVE BETTER ELECTRICALLY

Simplex

ANHYDREX XX





Bell Laboratories engineer Cyril A. Collins, B.S. in E.E., University of Washington, demonstrates new TV switching control panel for black and white or color. Complex switching connections are set up in advance; in a split-second a master button speeds dozens of programs to their destinations all over the nation. Special constant-impedance technique permits interconnection of any number of broadband circuits without picture impairment.

Telephone science speeds TV enjoyment

Telephone science plays a crucial part in your TV entertainment. An interesting example—one of many—is the latest TV switching center developed at Bell Telephone Laboratories.

Switching centers control the transmission of programs which come to your local TV station over Bell System facilities. To be available exactly on cue, programs must be switched at high speed and with very great accuracy.

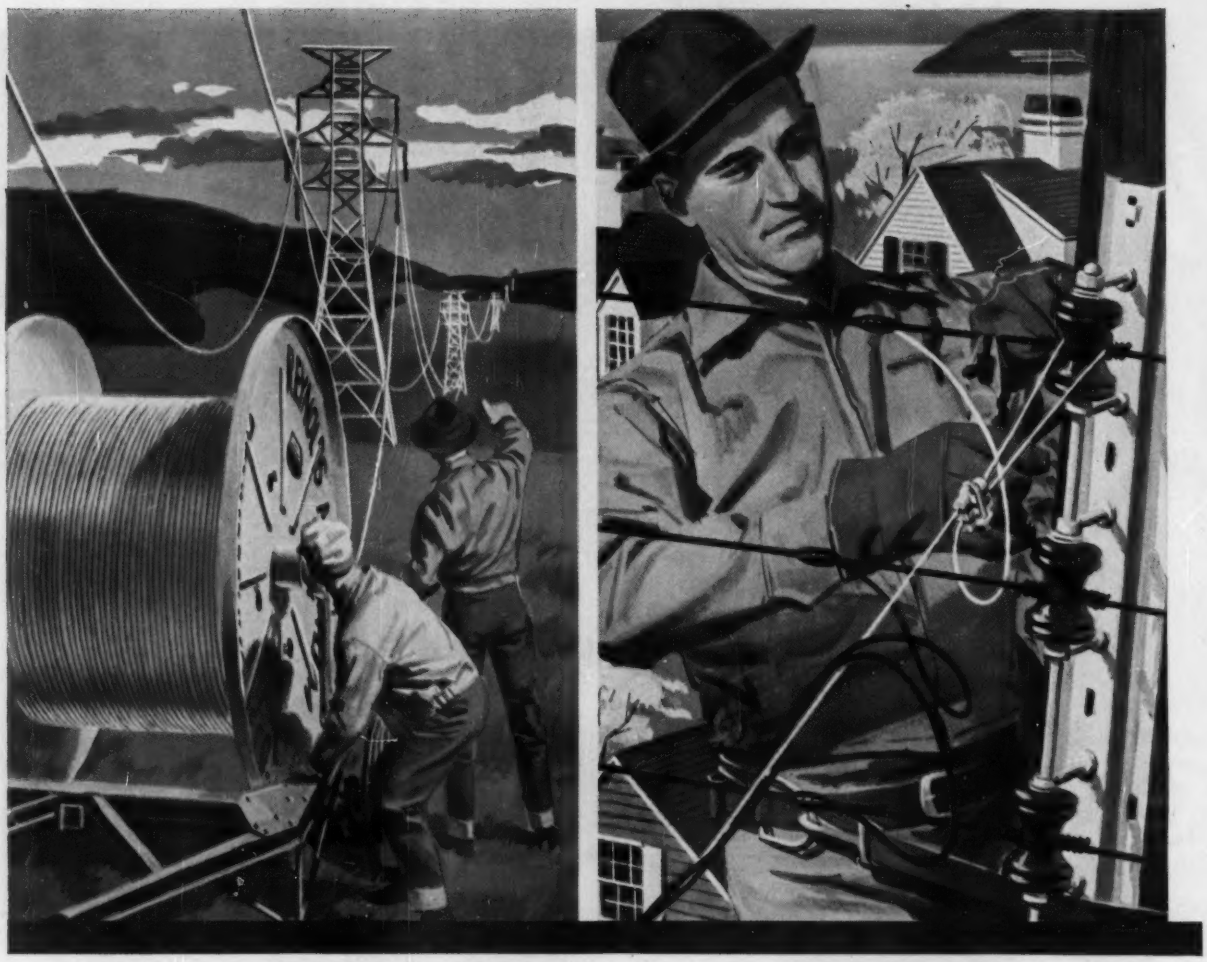
To create the new switching center Bell Laboratories engineers borrowed from the switching control art which handles your dial telephone calls. They developed a special control panel which puts complex switching patterns within the easy grasp of one man. By pushing buttons, he sets up—and double-checks—forthcoming network changes far ahead of time. On cue he presses a master button which sends the programs racing to their respective destinations around the nation.

To connect the broadband circuits, the Laboratories engineers developed a new video switch which operates on a constant-impedance principle. The new switch permits the interconnection of any number of circuits, without the slightest impairment of transmission quality.

Thus the technology which serves your telephone also works for your TV enjoyment.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT



For Quick Delivery on These:

ACSR

Strong, lightweight Reynolds Aluminum Conductor Steel Reinforced cuts transmission costs and installation costs on overhead lines. ACSR costs less per pound, provides more conductivity per dollar. It's 20% lighter, 50% stronger than the next most common cable material. Its light weight permits longer spans, cuts field installation time and labor. ACSR is available on the lightweight, easy-to-handle Non-Returnable Reels which were first developed by Reynolds.

COVERED CONDUCTOR

More and more power companies are finding Reynolds Aluminum Covered Conductor a real cost-cutter in secondary distribution lines and service drop. Available in single conductors, and self-supporting duplex, triplex and quadruplex cable, Reynolds Aluminum Covered Conductor costs less than copper, and is more economical to install. Its light weight allows easier handling, faster installation, longer spans. There is a choice of Neoprene or Polyethylene covering.

See "CIRCUS BOY", Reynolds exciting dramatic program, Sundays, NBC-TV.

Call Him:

REYNOLDS ELECTRICAL DISTRIBUTOR

For immediate delivery of the most-needed sizes of ACSR, covered conductor and self-supporting service drop, you can depend on your Reynolds Electrical Distributor. Utility men in all parts of the country have found the network of 65 Reynolds Electrical Distributors the easy answer to their supply and inventory problems. And you can draw on Reynolds technical services for assistance in planning all types of electrical applications of aluminum.

GET DETAILS NOW

Call your Reynolds Electrical Distributor listed in the next column or write to *Reynolds Metals Company, P. O. Box 1800-EL, Louisville 1, Ky.*

The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

Rely on these Reynolds Electrical Distributors

General Electric Supply Co. All locations
Westinghouse Electric Supply Co. All locations

ALABAMA
Matthews Electric Supply, Birmingham
Moore-Handley Hardware Co., Birmingham
S. B. S. Electric Supply, Florence

ARIZONA
Utilities Supply Co., Phoenix, Tucson

CALIFORNIA
American Wholesale Electric, Los Angeles
Capital Wholesale Electric, Sacramento
Gaugh Industries, Inc., Los Angeles
Pacific Utilities Supply, San Francisco

COLORADO
Hendrie & Bolthoff, Denver

DELAWARE
Artcraft Electric Supply, Wilmington

FLORIDA
Hughes Electric Co., Orlando
Raybro Electric Supplies, Tampa, Jacksonville, Miami, Orlando

GEORGIA
Albany Electric Supply, Albany
Lowe Electric Co., Macon

ILLINOIS
A. A. Electric Supply, Chicago

IOWA
B. L. Robinson, Inc., Burlington

KENTUCKY
E & H Electric Supply, Louisville
McComb Supply Co., Harlan
Tafel Electric & Supply Co., Louisville

LOUISIANA
Williamson Sales, Shreveport

MASSACHUSETTS
Hendrix Engineering Sales, Boston

MICHIGAN
Electric Wholesale Supply, Jackson
J. George Fischer & Sons, Saginaw
Morley-Murphy, Inc., Escanaba

MINNESOTA
Continental Marketing Corp., Minneapolis
Midway Electric Supply, Moorhead
Minnesota Electric Supply Co., Willmar
O. A. B. Supply Co., Duluth
Ready Supply, Minneapolis

MISSOURI
Columbian Electrical Co., Kansas City

MONTANA
Montana Electric Supply, Billings

NEBRASKA
Conrad R. Bangh, Omaha
J. E. Johansen Co., Lincoln
Kerrmeyer Co., Grand Island, Lincoln
Wright & Sellers, Omaha

NEVADA
Standard Wholesale Supply, Las Vegas

NEW JERSEY
Kay Electric Supply, Atlantic City

NEW MEXICO
Electric Supply Co., Albuquerque
Southwestern Electric Supply, Hobbs

NEW YORK
Turtle & Hughes, Inc., New York

NORTH CAROLINA
R. S. Jordan Co., Elizabeth City

OHIO
Lindsay Telephone Supply, Cleveland
Moock Electric Supply, Canton, Youngstown, Akron

OKLAHOMA
Star Electric Supply Co., Tulsa

OREGON
Stubbs Electric Co., Portland

SOUTH CAROLINA
Butts Electric Supply Co., Charleston
Graves Electric Supply, Greenville
Palmetto Electric Supply, Columbia
Shealy Electric Wholesalers, Greenville, Columbia

TENNESSEE
Mid-Valley Sales & Service, Nashville

TEXAS
Adams & Pruitt Supply, Amarillo
Electric Service & Supply, Odessa
I. W. Hynd Co., Midland
R & A Electric Supply, Wichita Falls
Southwestern Electric Supply, Lubbock
Superior Electric Supply, Odessa
Triangle Electric Supply, El Paso
Williamson Sales, Dallas, Houston

UTAH
United Electric Supply, Salt Lake City

WASHINGTON
Tinling & Powell, Spokane

WEST VIRGINIA
Fairmont Supply Co., Fairmont
Weirton Ice & Coal Co., Weirton

WISCONSIN
Ellison Electric Supply, Fond du Lac
Rahr's, Inc., Manitowoc
Morley-Murphy, Inc., Green Bay, Milwaukee, Wausau

"We like the convenient storage characteristics of POC Bushings ---no special procedure or special handling is required."

"These totally-enclosed oil-filled bushings for lower voltages will surely create a trend."

"THE CADILLAC OF BUSHINGS!"

"We gave it more severe tests than any other bushing we ever tested --- and we approve it without modification or alteration."

"Excellent Design."

"AN EXCELLENT DESIGN, AND MANUFACTURED IN THE BEST OF FACILITIES."

"An ideal design, and well-suited to applications where existing bushings cannot be used."

"A superior bushing, but we'd expect nothing less from Lapp."

"Seems to be an excellent bushing; we can find no faults whatever."

APPROVED and ACCEPTED

Lapp

POC* BUSHING

*PAPER-OIL CONDENSER TYPE
TOTALLY-ENCLOSED CORE
ASA STANDARD

In its first six months after announcement, the Lapp POC* Bushing has won the enthusiastic endorsement of utility engineers and equipment manufacturers from coast to coast. Rigorous characteristic and performance tests have been conducted in customer laboratories or in the Lapp laboratory under customer supervision. Practically every utility and every equipment manufacturer who have seen this bushing have placed it on Approved or Standards Lists—or tell us they are in process of approving it.

Lapp POC* is the bushing design of the future —ready to serve you reliably today.

Lapp Insulator Co., Inc., Le Roy, N. Y.

CONDENSERS BY MARIND

Thoroughly experienced design engineering and manufacturing staff. Every Marind job is backed by this Company's international reputation for outstanding quality, service, performance.

MARIND

POWER • INDUSTRIAL EQUIPMENT

Industrial Products Division

MARYLAND SHIPBUILDING & DRYDOCK COMPANY

BALTIMORE 3, MARYLAND • *Representatives in Principal Cities*

The Best Performer

WORKS ENERGETICALLY BEHIND THE SET

➔ You don't see it or hear it—it never takes a bow, but Bituminous coal is the power source behind most of your armchair entertainment. Fortunately for you the supply is practically limitless. Billions of tons of proved reserves in B&O fields alone provide a constant, low-cost supply of energy for hundreds of years. As modern marvels make life more enjoyable, *you can bet Bituminous is behind them,* serving efficiently and economically. *Ask our man!*

EXPERT ADVICE FROM OUR COAL TRAFFIC REPRESENTATIVES
on the right Bituminous energy source for any power requirements.
Contact Coal Traffic Department,
B & O RAILROAD, BALTIMORE 1, MD. LExington 9-0400

Baltimore & Ohio Railroad

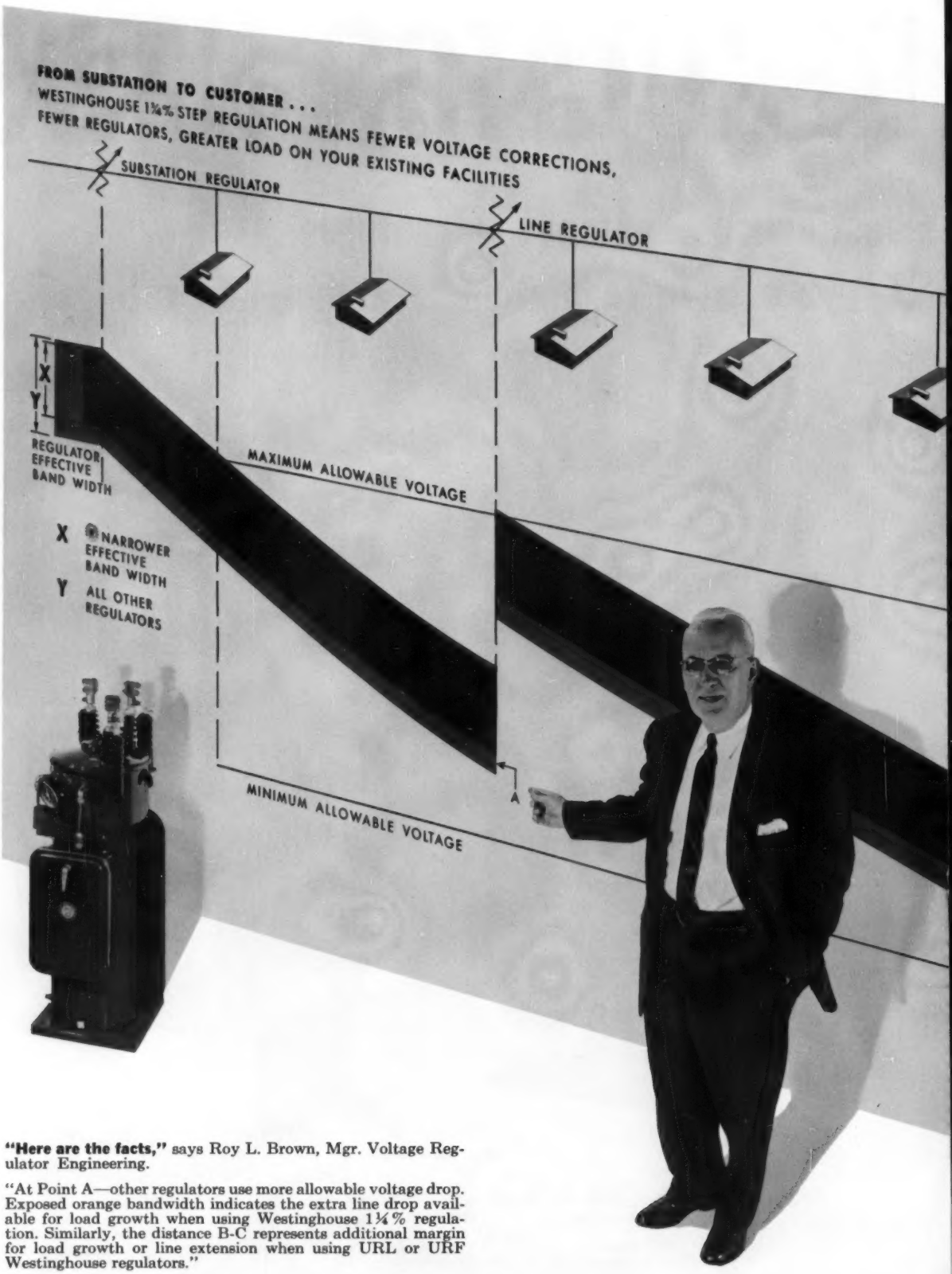
REGULATOR NEWS

Westinghouse extends advantages of 1¼% step regulation to higher kva ratings

Left—URF regulator extends range of 1¼% step regulation . . . reduces your initial investment for regulators up to 167 kva.

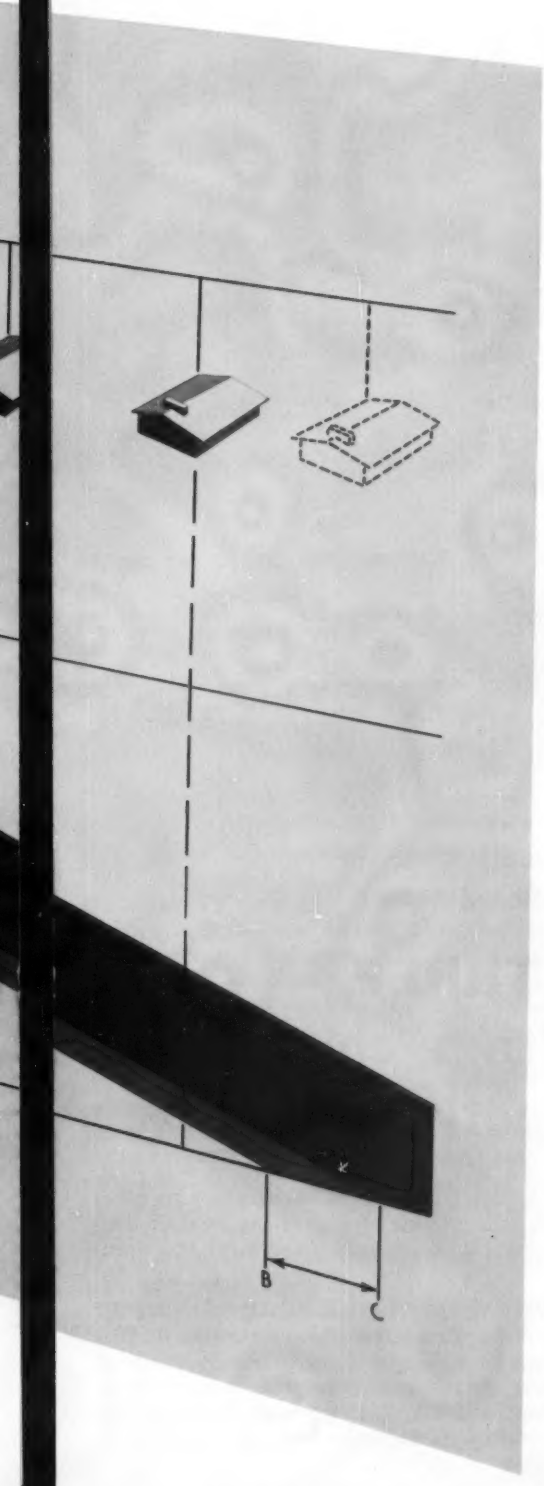
Right—URL regulator . . . over 10 years of field experience has proved the superiority of 1¼% step regulation.

YOU CAN BE SURE...IF IT'S Westinghouse


FROM SUBSTATION TO CUSTOMER . . .
WESTINGHOUSE 1¼% STEP REGULATION MEANS FEWER VOLTAGE CORRECTIONS, FEWER REGULATORS, GREATER LOAD ON YOUR EXISTING FACILITIES
SUBSTATION REGULATOR
LINE REGULATOR
X
Y
REGULATOR EFFECTIVE BAND WIDTH
MAXIMUM ALLOWABLE VOLTAGE
X NARROWER EFFECTIVE BAND WIDTH
Y ALL OTHER REGULATORS
A
MINIMUM ALLOWABLE VOLTAGE

"Here are the facts," says Roy L. Brown, Mgr. Voltage Regulator Engineering.

"At Point A—other regulators use more allowable voltage drop. Exposed orange bandwidth indicates the extra line drop available for load growth when using Westinghouse 1¼% regulation. Similarly, the distance B-C represents additional margin for load growth or line extension when using URL or URF Westinghouse regulators."



It's a fact . . .
Westinghouse 1-1/4% step regulation

holds narrowest effective bandwidth, gives you more revenue

Westinghouse 1-1/4% step regulation more effectively meets the three basic distribution voltage conditions — you gain a narrower effective bandwidth; permits heavier loads, less line equipment.

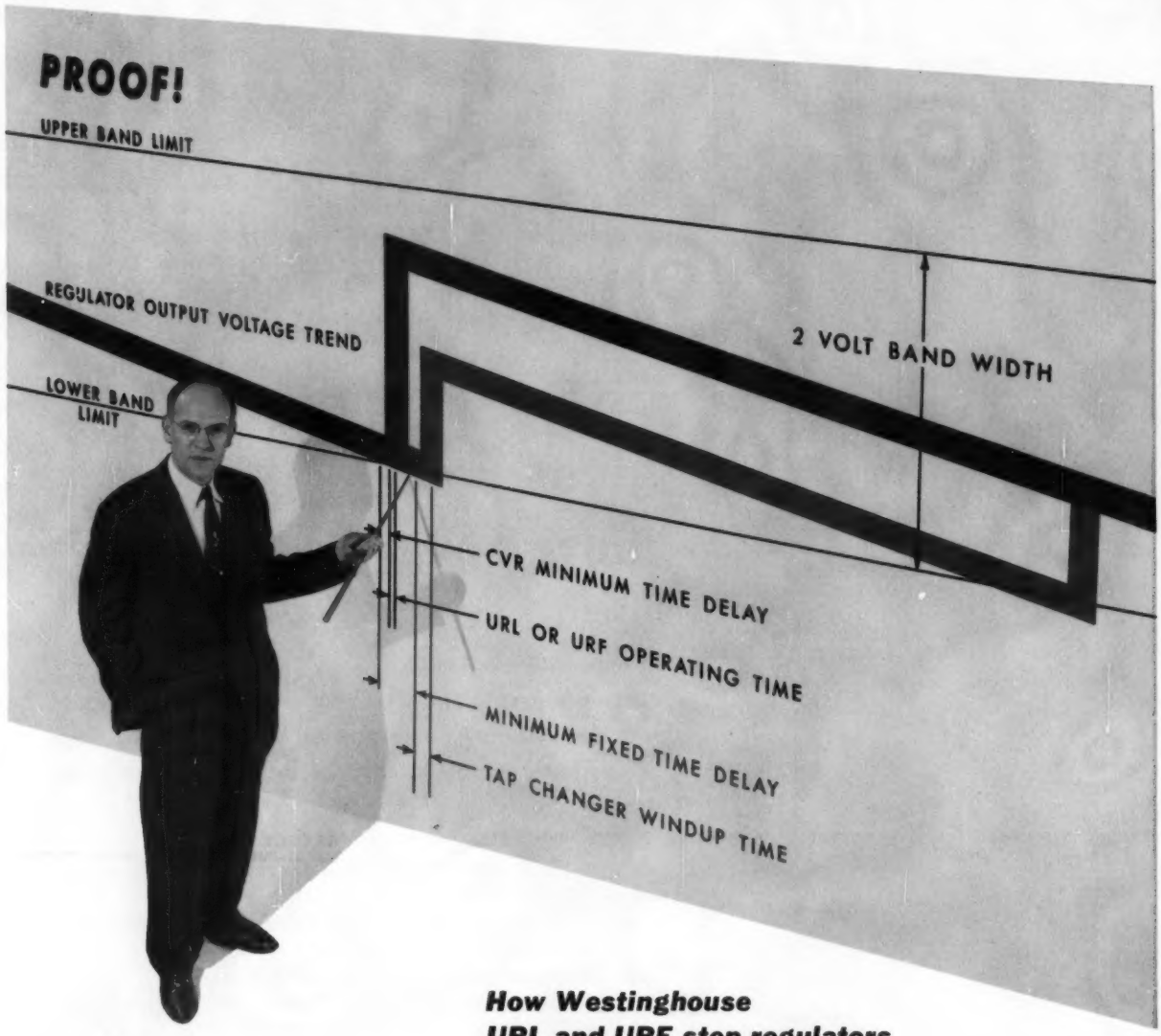
Here is what Westinghouse new URL and URF step voltage regulators can do for you:

1. Save you money because satisfactory voltages can be furnished to loads farther out on the line.
2. Increase revenue by allowing heavier loading of existing lines, hold effective regulator voltage bandwidth closer to the limits set on the control.
3. Because of faster relay operation on large voltage changes and a tap changer that responds 15 times faster than other types of mechanisms, URL and URF regulators provide protection against runaway voltages which can damage user equipment.
4. Make possible a minimum total regulation equipment investment:
   (a) Longer lines
   (b) Fewer regulators
   (c) Deferred expansion to meet growing loads

YOU CAN BE SURE... IF IT'S Westinghouse

This is system operating flexibility you get with no other regulators

HERE'S WHY . . .



How Westinghouse URL and URF step regulators

meet all THREE basic voltage conditions more effectively

SMOOTH VOLTAGE CHANGES

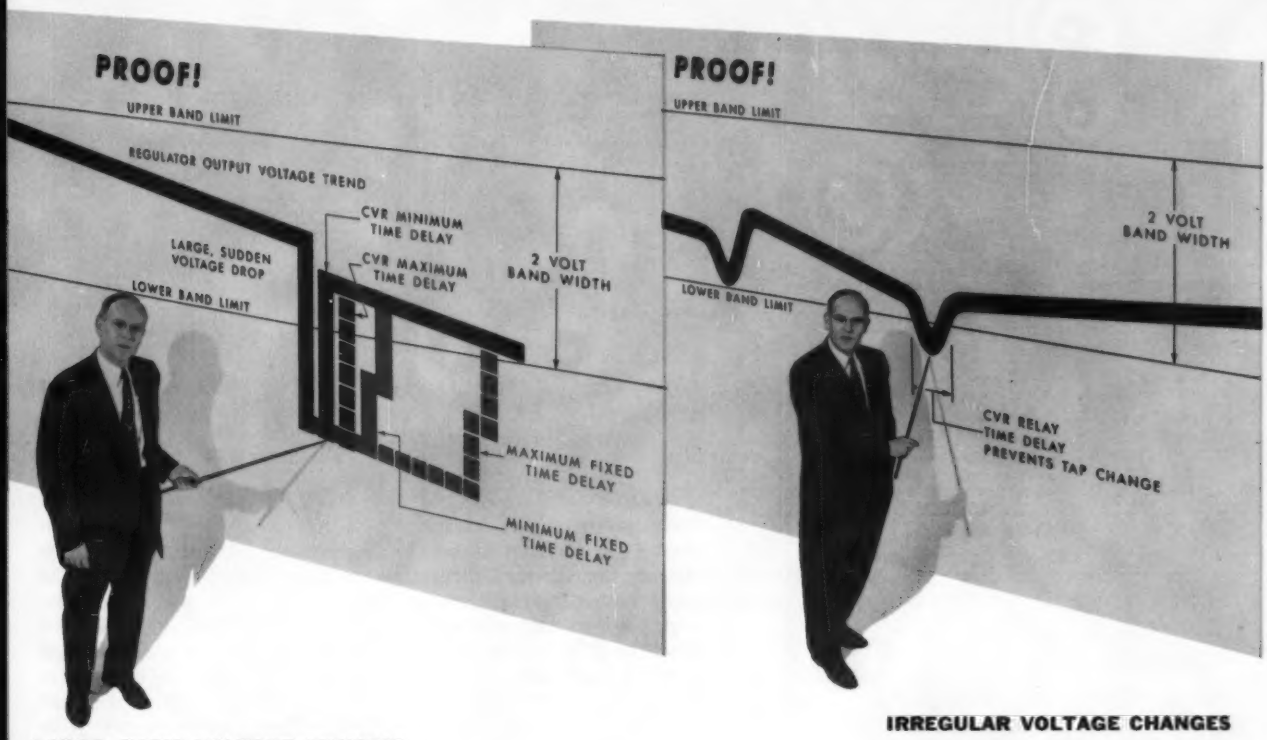
Fixed time delay on ordinary regulators allows voltage to go outside band limit before operation. The Westinghouse CVR induction disc relay "reads" voltage. When lower or upper band limit is reached, contacts close; instant-response tap changer corrects voltage 15 times faster than other tap changers.

RESULT . . .
A NARROWER EFFECTIVE BANDWIDTH

THE PURPOSE OF A REGULATOR is to maintain an effective voltage level which will provide top operating revenue consistent with the least possible equipment investment and minimum maintenance.

THREE EXCLUSIVE WESTINGHOUSE REGULATOR FEATURES give you this optimum voltage correction. (1) The unique new CVR voltage regulating relay with integral, adjustable, inverse time delay; (2) the instant-response tap changing mechanism, and (3) the 1¼% step giving regulation on a 120-volt base of 24 volts in 16 steps of 1½ volts each.

YOU CAN BE SURE...IF IT'S



LARGE, RAPID VOLTAGE CHANGES

CVR relay disc accelerates to close contacts and operate instant-response tap changer in a fraction of the time taken by other regulators. Because of the fixed time delay of ordinary regulators, steep voltage changes may run voltage so far above or below set band limits that two or more ¾-volt steps are required to bring voltage within the band. Westinghouse regulators, however, offer the quickest recovery under such voltage conditions.

RESULT . . .
A NARROWER EFFECTIVE BANDWIDTH

IRREGULAR VOLTAGE CHANGES

Westinghouse CVR relay induction disc with its damping magnet integrates voltage and time; its inverse time delay characteristic prevents relay and tap changer operation during self-correcting conditions.

RESULT . . .
NO UNNECESSARY OPERATIONS

New CVR relay "reads" voltage, evaluates need for correction, eliminates unnecessary tap changes

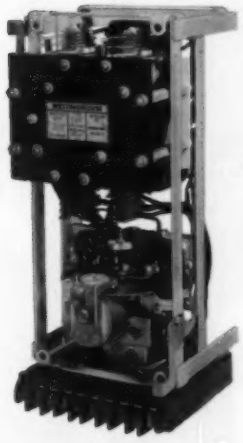
CVR voltage regulating relay is an induction disc device with built-in inverse time delay characteristics. On a smooth, slow-changing voltage (Figure 1), the disc position will follow the voltage, and will close contacts to start corrective action by the tap changer whenever voltage reaches pre-set band limits.

Ordinary regulators with fixed time delay allow wider voltage deviations from set limit.

But in the Westinghouse URL and URF regulators, the CVR relay operates immediately . . . voltage is restored to within band limits. Result—narrower *effective* bandwidth.

On large, rapid voltage changes, such as may result from switching in other parts of the system or from rapid load changes (Figure 2), the CVR relay disc *accelerates*—contacts are made, and again corrective action by the tap changer starts immediately. Voltage is quickly restored to normal. Result—narrower *effective* bandwidth.

Finally, irregular voltage changes (Figure 3), such as result from motor starting, are usually short-time, self-correcting disturbances. The Westinghouse CVR relay disc integrates voltages—automatically provides time delay through the averaging effect of the damping magnet. Prevents unnecessary operations which would lead only to increased maintenance.



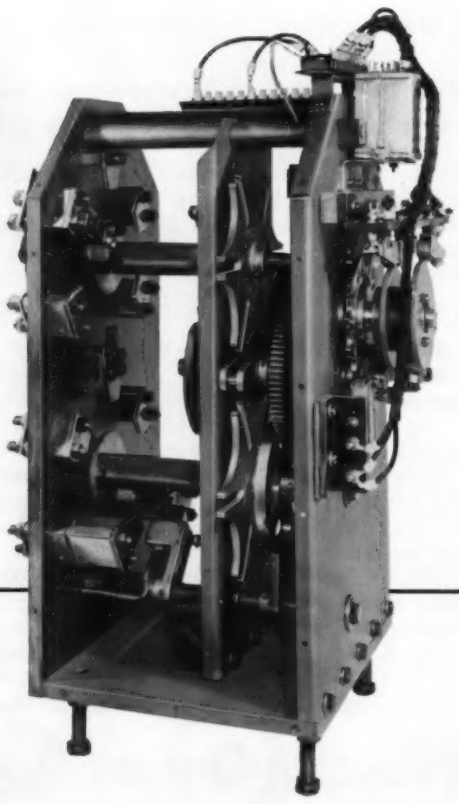
Unique new Westinghouse CVR relay with inverse time delay characteristics . . . provides best voltage regulation available under all voltage change conditions.

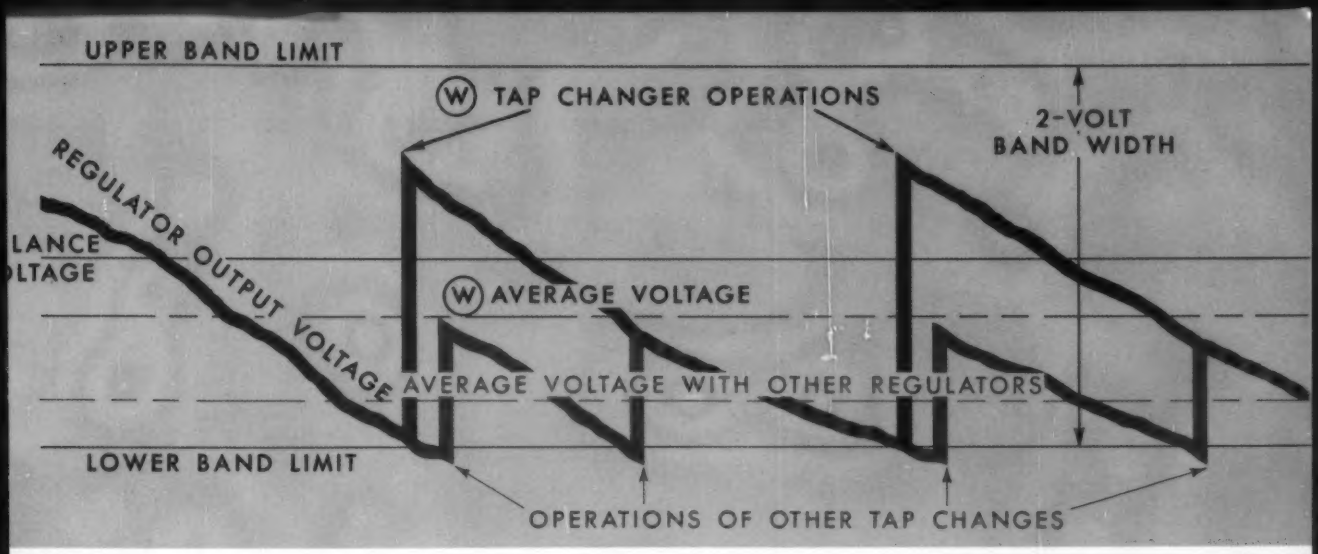
Westinghouse

Instant-response tap changer corrects voltage . . . 15 times faster than other tap changers

How Westinghouse direct-drive Geneva gear tap changer and CVR relay work together to achieve narrowest effective bandwidth

The *direct-drive Geneva gear* tap-changing mechanism responds instantly to the command of the voltage regulating relay. As soon as the relay contacts close, the tap changer motor starts driving the Geneva pinion. No windup time is involved. The pinion engages the Geneva gear and immediately moves the tap changer contacts to the next position. The advantages of directly driving the Geneva gear are dramatically illustrated in a comparison of time required for Westinghouse regulators to traverse from maximum raise to maximum lower with that of other regulators. The directly driven Geneva gear can, if so directed by the CVR relay, operate the tap changer over full range in only 13 seconds. Other drives require 3½ to 5 minutes from maximum raise to maximum lower. The elimination of this unnecessary time delay further contributes to A NARROWER *EFFECTIVE* BANDWIDTH.





Effective voltage of 16-step regulation is closer to balance voltage . . . with fewer operations

When a 2-volt bandwidth is used, the voltage level will always be more than one volt from the balance voltage when the relay initiates a tap change. With its 1½-volt steps, the Westinghouse URL and URF tap changers will bring voltage back to the balance level with a single operation; whereas, a ¾-volt step regulator will never bring voltage back to this level.

Westinghouse 16-step regulation means . . . 42% fewer operations, 15% less contact erosion. Result? Reduced maintenance, longer life

Optimum contact speed minimizes burning

Contact speed and burning are directly related—excessive burning of contacts will occur with either too slow or too rapid contact break. The former delays arc extinction, the latter frequently causes flashover between stationary contacts. Exclusive Westinghouse direct-drive Geneva gear mechanism consistently assures optimum speed. Arc extinction is achieved at first current zero. Flashover is eliminated, burning minimized, contact life significantly lengthened.

Contact burning and frequency of operation

Contact burning or erosion does not increase directly as the size of the step; therefore, the contact burning for one 1½-volt step is less than for two ¾-volt steps. Tests have shown that, on the average, the 16-step tap changer makes 42% fewer operations than a 32-step tap changer, and that the 16-step contacts average 15% less erosion for the same service. These two factors make 16-step operation result in reduced maintenance and longer life.

YOU CAN BE SURE...IF IT'S Westinghouse

Here is what new Westinghouse URL and URF regulators do for you:

- Hold a narrower *effective* bandwidth
- Provide protection against runaway voltages which can damage user equipment
- Increase revenue by permitting heavier loading of existing lines
- Save you money because satisfactory voltages can be furnished to loads farther out on the line

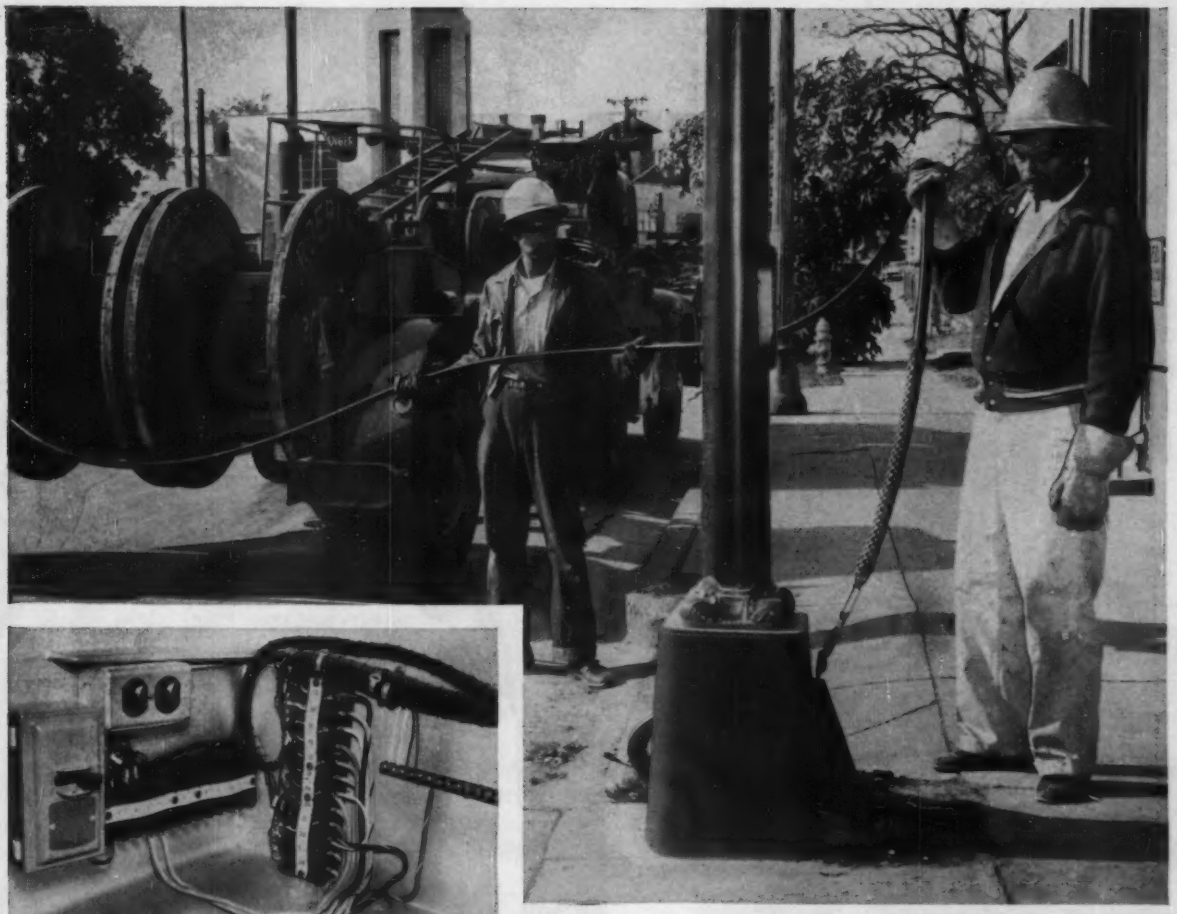
ADD TO THIS THE WESTINGHOUSE LOAD RANGE SELECTOR . . . allows higher currents at reduced range operation. With LRS, you get increased capacity on all URL-URF regulators . . . 160% of rated current at plus or minus 5% regulation up to 400 amperes.

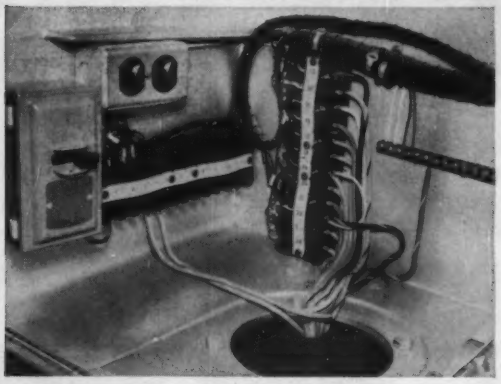
Only Westinghouse offers these moneysaving product features:

- Separate tap changer compartment
- Inverse time delay relay
- Direct-drive Geneva gear tap changing mechanism
- 42% fewer tap changer operations
- Longer life contacts
- Corrosion-resistant tank

Get more revenue for power delivered. Specify new Westinghouse URL-URF regulators on your system. J-70804

YOU CAN BE SURE...IF IT'S Westinghouse





Individual conductors in the control box are color-coded with vinyl plastic, over insulation of polyethylene.

Cable being installed was manufactured by John A. Roebling's Sons Corporation.

Polyethylene and vinyl on cable...

teamed against underground troubles

These men in San Antonio, Texas, are installing traffic signal cable that is completely insulated and jacketed with plastic.

The outer covering is tough BAKELITE Brand Vinyl Plastic. Notice that it's being pulled with a Kellems grip. The smooth-surfaced jacket makes pulling through ducts and conduits easy. And the vinyl plastic guards against alkalies, acids, and motor oil.

Inside, the individual conductors, shown in the inset above, have a moisture-resistant colored vinyl jacket over insulation of BAKELITE Brand Polyethylene. The polyethylene was selected for its high insulation resistance, low dielectric constant, and excellent dielectric strength.

You'll find that line wire, service drop, and power cable, as well as communication and control cables, are improved through use of BAKELITE Polyethylene and Vinyl Plastics. Their high standards are assured by a rigid quality-control system. For the latest information on the use of these materials for wire and cable, get Kabelitems No. XX by writing Dept. YC-53.

BAKELITE
BRAND
PLASTICS

UNION CARBIDE

BAKELITE COMPANY, *Division of Union Carbide Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

The terms BAKELITE, UNION CARBIDE and the Trefoil Symbol are registered trade-marks of UCC.

"HERE'S SOMETHING NEW IN TRANSFORMER CONNECTORS"

KUHLMAN "Salesman of the Week"

If you can identify this Kuhlman representative, and are the first one to notify Dept. SA-1, Kuhlman Electric Co., Bay City, Mich., you will receive a valuable gift.

"It's a real pleasure to introduce to you the new Kuhlman low voltage connector for either aluminum or copper conductors.

"As you know, aluminum conductors cold flow more than copper when first connected to a transformer terminal. Then in normal operation they tend to loosen. A common solution is to increase the resiliency of the connector by adding a spring device. I consider the new Kuhlman connector, however, a much simpler, more efficient design. Here's how it works:

"First, when tightened, the eye bolt piece (shown as c above) stretches to accommodate the conductor and through inherent resilience holds the conductor firmly in place. Second, a greater contact surface (a) and (b) is provided for the conductor—particularly important for aluminum. Together, points (a), (b) and (c) maintain a firm contact under all operating conditions without over-stressing the conductor —whether copper or aluminum.

"The new Kuhlman connector is just one more example of how Kuhlman engineering aids the progress of your industry —in this case the recent trend to aluminum conductors. Write today for interesting two-volume story on transformer connectors appearing in present issues of our *Kuhlman Kurrent* house organ."

5713b

KUHLMAN ELECTRIC COMPANY

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

Midwest institution gets lesson in turbine lubrication

...*learns advantages of using* NONPAREIL *Turbine Oil*

In 1939, a Midwestern institution installed a 350 kw. turbine. In less than a year, considerable difficulty was experienced with oil sludge and deposits. A Standard Oil Company industrial lubrication specialist recommended switching to NONPAREIL Turbine Oil as a solution to the problem. He supervised the draining and cleaning of the turbine system and the installation of NONPAREIL Turbine Oil.

The turbine, equipped with NONPAREIL, was started up in June, 1941. Periodic tests showed that the neutralization number of the oil was never above 0.06 mg. KOH/g. Having had this experience with NONPAREIL Turbine Oil, when a new 750 kw. turbine was installed in 1947, only NONPAREIL was considered. In 1954 when a 1,000 kw. turbine replaced the 350 kw. one installed in 1939, NONPAREIL was again the first choice of the institution management.

The reason why NONPAREIL can deliver this kind of performance is this: NONPAREIL is refined from finest quality oil. An oxidation inhibitor is added to NONPAREIL which checks acidity formation even better than natural inhibitors normally found in oil. The inhibiting of acid formation in NONPAREIL is so complete Standard Oil can guarantee that the neutralization number of NONPAREIL Turbine Oil will never exceed 0.15 mg. KOH/g. for the life of the turbine.

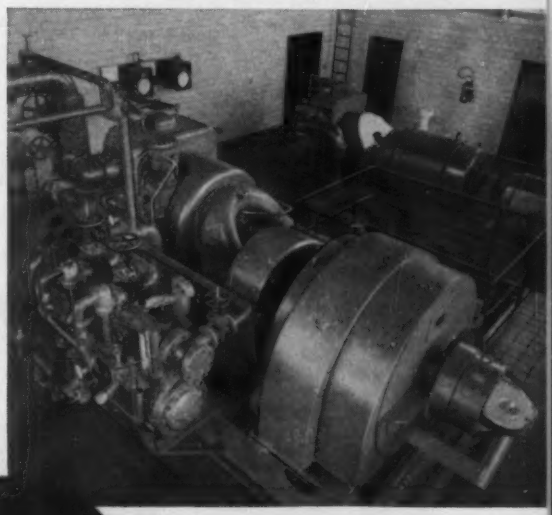
More facts about NONPAREIL Turbine Oil are readily at hand. Get them from your nearby Standard Oil industrial lubrication specialist. There is one of these men in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

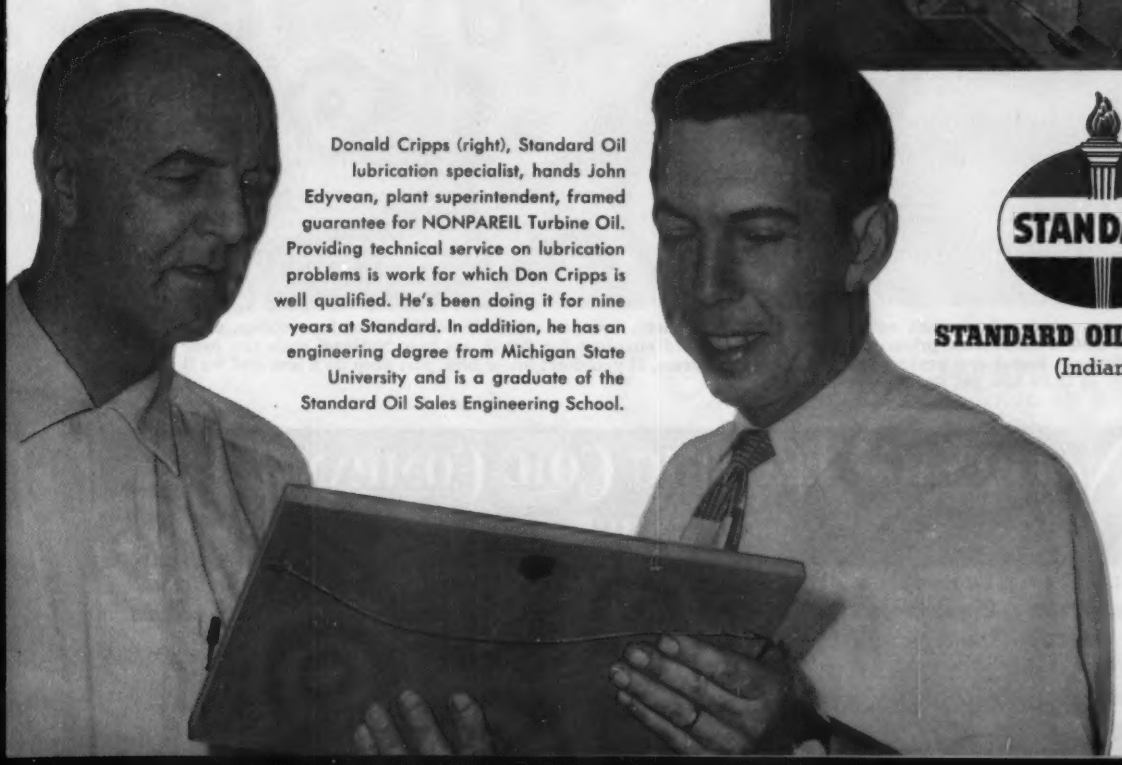
Quick facts about

NONPAREIL TURBINE OIL

- Does not form acids.
- Does not sludge.
- Maintains good demulsibility.
- Guaranteed to last the life of the turbine.

A 1,000 kw. and a 750 kw. turbine provide power to this Midwest institution. Both have used NONPAREIL Turbine Oil since the first day they went into service.





Donald Cripps (right), Standard Oil lubrication specialist, hands John Edyvean, plant superintendent, framed guarantee for NONPAREIL Turbine Oil. Providing technical service on lubrication problems is work for which Don Cripps is well qualified. He's been doing it for nine years at Standard. In addition, he has an engineering degree from Michigan State University and is a graduate of the Standard Oil Sales Engineering School.

STANDARD

STANDARD OIL COMPANY
(Indiana)

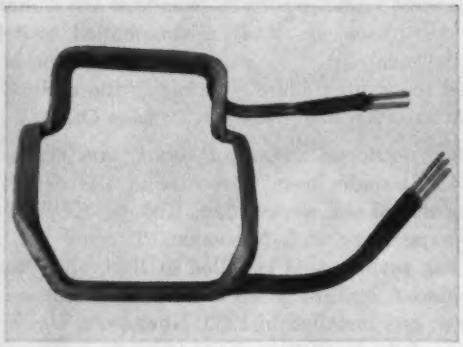
National Replacement Coils

Help Keep Vital Motors and Generators on the Job . . .

. . . IN THE ELECTRIC POWER INDUSTRY

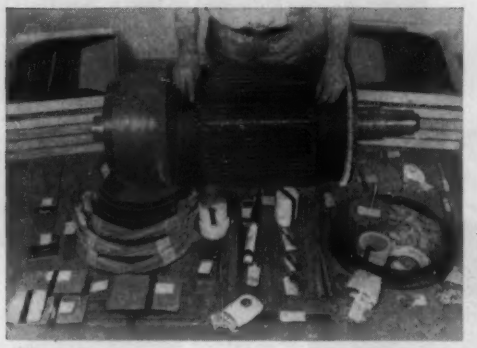
The photo shows part of a set of 54 stator coils for a large AC turbo generator. Rewinding of equipment of this size is normally done on the job site. National can either supply the coils only (with the customer handling the complete installation) or National can send a full winding crew or send supervisory personnel (with the customer supplying the labor).

. . . IN THE MINING INDUSTRY



Mines use National coils in the motors which power mine locomotives, shuttle cars, conveyors and other equipment. National "grew up" in the coal fields and really understands the electrical maintenance problems of the mining industry. The photo shows a typical armature coil for a mine locomotive motor.

. . . IN THE RAILROAD INDUSTRY



Some railroads send their traction motors to National shops for rewinding. Others perform the work in their own shops, using National replacement coils and winding supplies. The photo shows the variety of materials which go into a complete National rewinding kit for a traction motor armature.

. . . IN THE STEEL INDUSTRY

The steel industry depends on National for replacement coils because rugged, reliable National coils have proved their ability to meet the test of tough steel mill operating conditions. The photo shows armature coils for a DC mill motor being dipped in a silicone varnish to protect them against deterioration due to high temperatures.

When you need coils for any rotating electrical equipment, you can count on National for top quality, good service and a reasonable price. Ask your National field engineer for details on how National coils can help simplify your motor and generator maintenance problems. If you don't know him, just drop us a line and we'll arrange to have him get in touch with you.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A. TRADE MARK

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

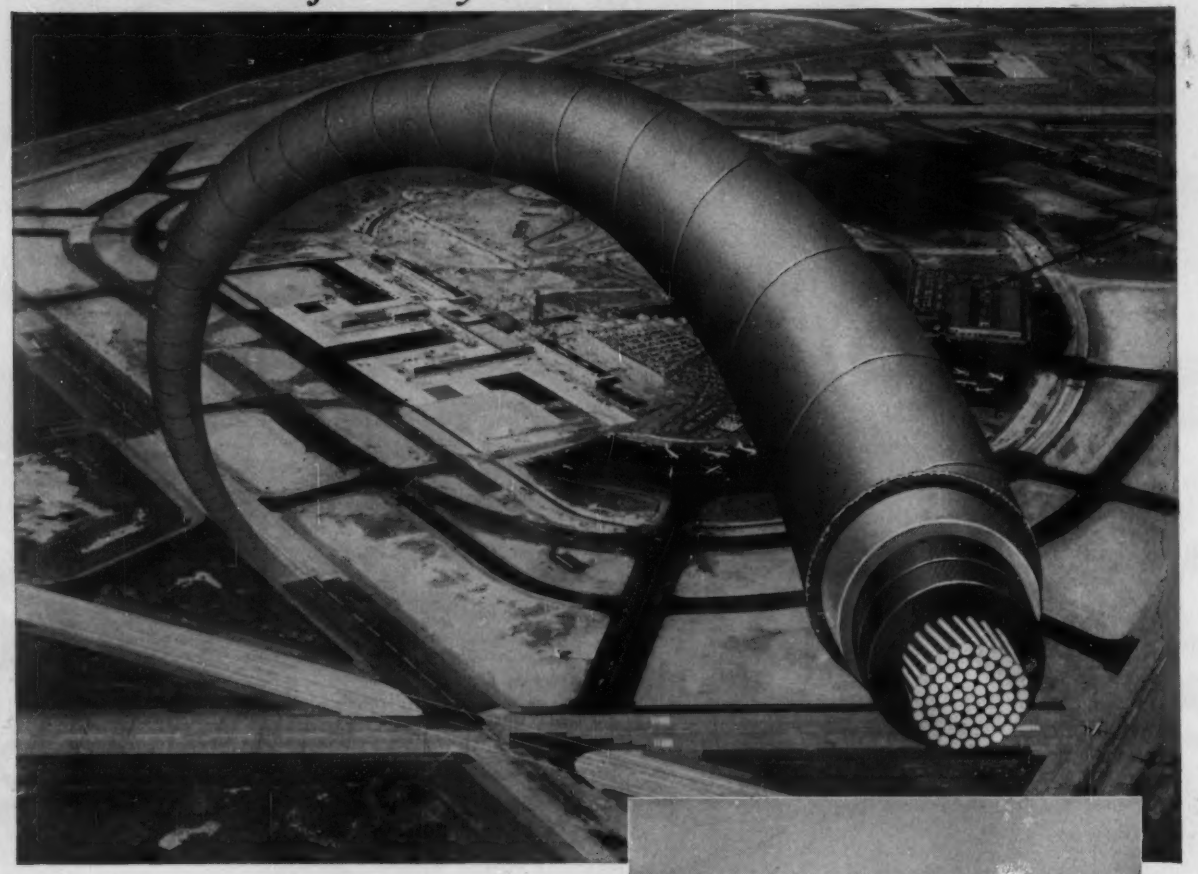
ANDERSON ELECTRIC

Performance at Point-of-Contact is what counts! Anderson Electric's new U-bolt aluminum parallel groove connector with COVER ALL spacer . . . maintains cable configuration . . . speeds installation . . . provides more area contact . . . increases range . . . increases pull-out strength . . . assures inhibitor protection.

ANDERSON ELECTRIC CORPORATION
Birmingham 1, Alabama

Aluminum & Bronze Power Connectors • Clamps • Fittings • Accessories for SUBSTATIONS • TRANSMISSION • DISTRIBUTION

Another call for Collyer . . .



at N. Y. International Airport

. . . OVER FORTY MILES OF COLLYER CABLE!

To light up the terminal area and meet the staggering power supply requirements of New York International Airport's new $90,000,000 "Terminal City", The Port of New York Authority has approved the installation of more than 40 miles of Collyer Rubber, Lead and Neoprene Hose Jacketed Cable.

When completely installed by the Plymouth Electrical Construction Company — one of New York's leading electrical contractors — this vital network of Collyer Cable will feed nearly every "Terminal City" building and hangar. Included will be the new eleven-block-long International Arrival Building and its adjacent Foreign-Flag Airline Wing Buildings.

Power Cables • Control Cables
Switchboard Wires • Service Cables
Series Lighting Cables • Building Wires

For quality construction and maximum serviceability on all types of municipal or private installations, it pays to "call on Collyer" for cable. Let us quote on your requirements. Write Collyer Insulated Wire Co., 245 Roosevelt Ave., Pawtucket, R. I.

Collyer

New "Twist" in Arresters...

LONGER ARRESTER LIFE

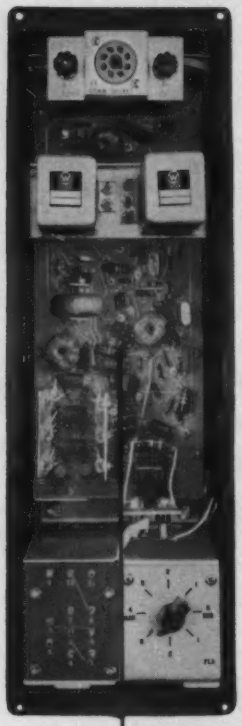
It's the Westinghouse exclusive Mobilarc gap —employing a radically polarized ceramic permanent magnet. Applying the left-hand motor law, it spins or "twists" the arc around a longer path on the gap electrodes . . . No consequential pitting or plating, even with as many as 1300 surge and follow-current discharges or with long duration surge discharges . . . No deterioration of the gap or consequent lowering of 60-cycle spark-over. Tests indicate magnet life to be infinite.

You need such performance if you follow the trend to use arresters at 75% to 80% voltage ratings—to protect transformers against long duration switching surges as well as lightning. All Westinghouse SVS, SV, and LVS station and line type arresters are equipped with Mobilarc gaps—and there is no initial investment premium. Complete engineering details and ratings are available from your Westinghouse sales representative—or from Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-60905

YOU CAN BE **SURE**...IF IT'S

Westinghouse



Completely Transistorized Carrier

No tubes to stock

1/20 the space requirements

printed circuits

90% reduced battery power

MAXIMUM SYSTEM RELIABILITY

Completely Transistorized Westinghouse Carrier
field tested and proved
since 1954 by a large eastern utility

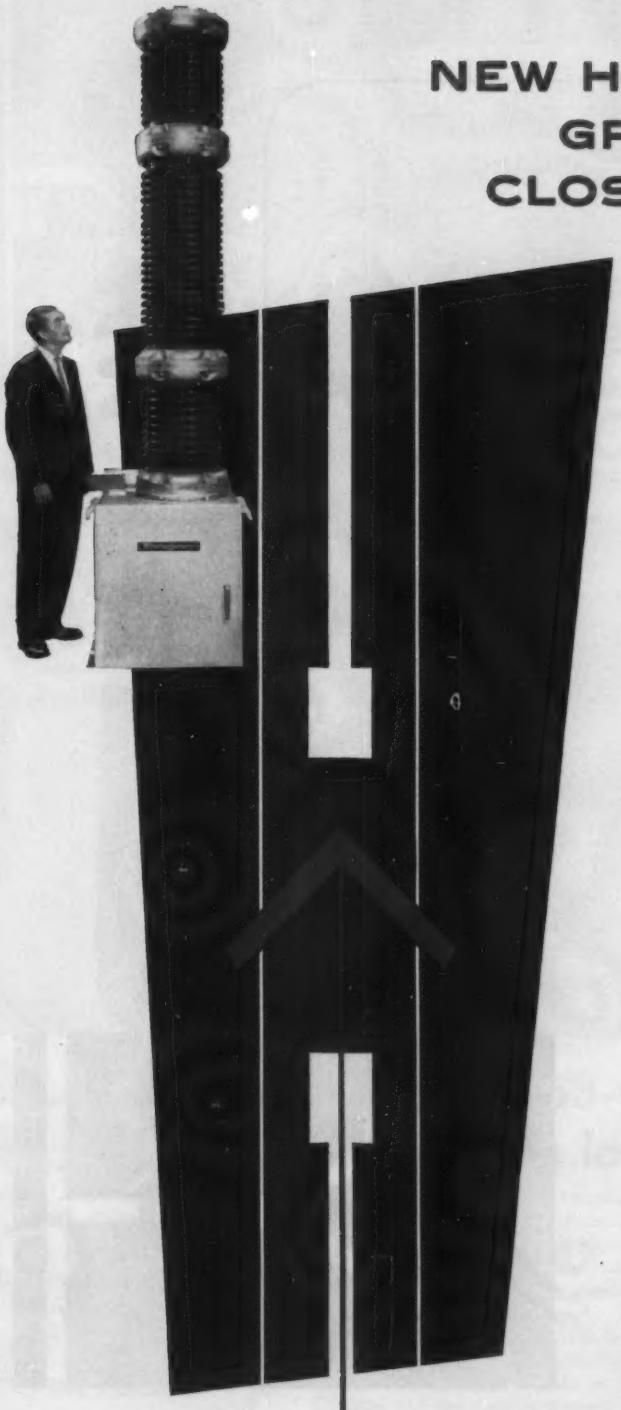
"Miracle" transistors could, but didn't "revolutionize" utility protective relaying practices—until they were applied to KR Carrier by Westinghouse in 1953—and tested and proved since 1954 in actual field service by an eastern utility.

In addition to the advantages listed above, the test and inspection schedule is greatly reduced. Maintenance drops to nearly nothing. The apparently infinite life of transistors means tops in reliable service. Inter-channel interference virtually disappears allowing more, fully reliable channels in the same band width. And you get the bonus of voice-communication for relay setup and adjustment in addition. All details, and field data, are available from your Westinghouse sales representative or from Westinghouse Electric Corporation, Carrier-Microwave Department, Box 7425, Halethorpe 27, Maryland. J-60903

YOU CAN BE SURE...IF IT'S

Westinghouse

NEW HIGH SPEED GROUNDING SWITCH CLOSES IN 5-CYCLES



Applied by P. P. & L. to Protect Large Power Transformers by Initiating Tripping of Remote Circuit Breakers*

Six times the speed of conventional grounding switches—fully enclosed and impervious to weather. It's revolutionary in design.

The 196-kv unit illustrated is one of two units at the P. P. & L. Peckville substation. In case of trouble in the zone protected by the transformer differential relays, the relays operate the grounding switch, initiating a ground on the line. This ground fault trips circuit breakers at the remote end of the line and clears the circuit before extensive damage can occur. This scheme is much more economical and just as reliable as other methods of protection.

The contacts and mechanism are fully enclosed. Blade action is reciprocal instead of swinging. Closing time is minimized by locating the contact structures relatively close together in an atmosphere of high-dielectric sulphur hexafluoride gas. The entire assembly is sealed so that replenishing gas is not necessary more often than every two or three years. The SF_6 itself does not deteriorate. Icing and temperatures as low as –40° have no effect on reliability or speed of operation.

Other voltage ratings of 69-, 115-, 138- and 161-kv will be available shortly.

Complete information, including user application particulars, is available from your Westinghouse sales representative.

J-60904

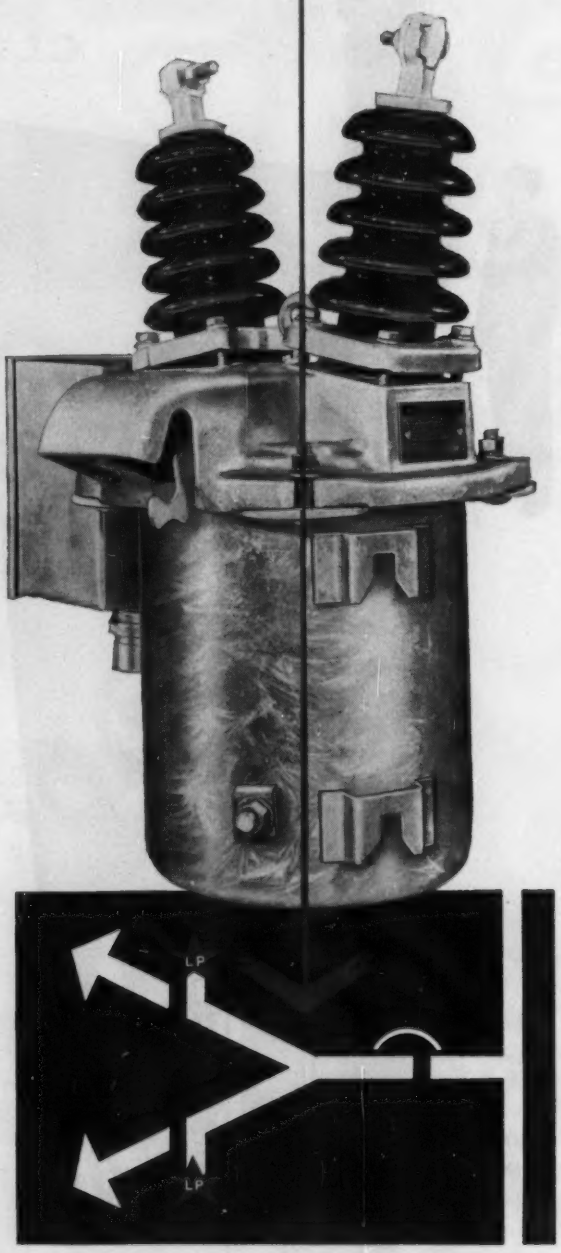
* Pennsylvania Power & Light Company was the first utility to plan the application of high-speed grounding switches. Westinghouse was commissioned by P. P. & L. to develop a 196-kv grounding switch capable of closing 20,000 amperes in five cycles instead of the conventional fifteen to thirty cycles.

YOU CAN BE SURE...IF IT'S

Westinghouse

A Westinghouse Exclusive

A FOUR HOUR LOAD PICKUP JOB DONE IN FIVE MINUTES



. . . by two new Westinghouse automatic load pickup switches.

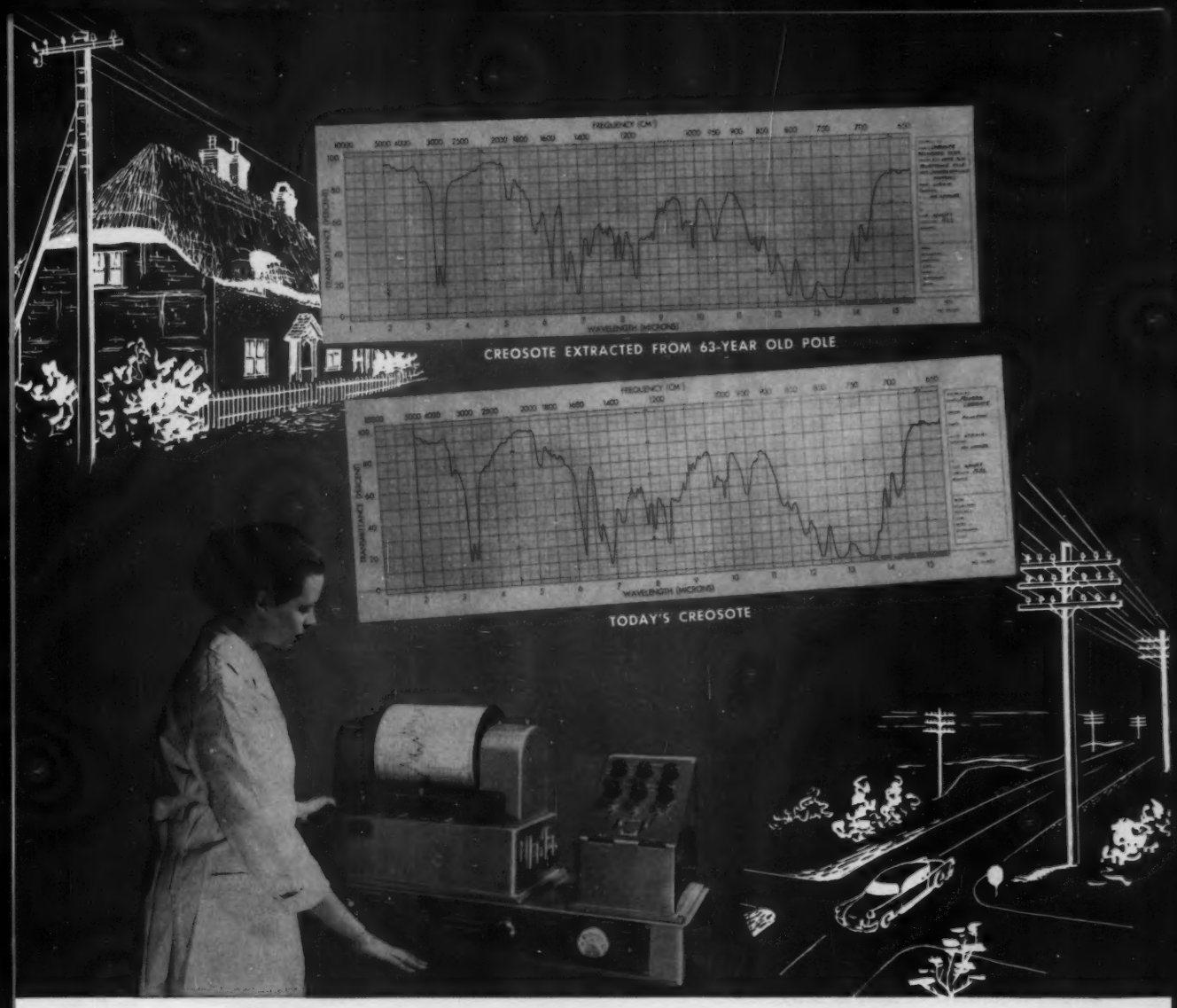
Manual restoration on the same circuit, by conventional sectionalizing methods, required four hours and much man power. The line covered 75 circuit miles of 6.9-kv service, with 1309-kva transformer capacity. Under automatic load pickup re-energization, *no protective equipment was subjected to overload for more than one-half cycle.*

The Westinghouse LP automatic load pickup switch is a 15-kv, 200-ampere unit for all voltage ratings from 2.3- to 15-kv. Thermal time-delay is available in increments of two seconds to five minutes. Complete details are available from your nearby Westinghouse sales representative — or by requesting Bulletin 38-860 from Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60909

For a complete engineering report on the application described, write the address at left, asking for reprint No. 5235.

YOU CAN BE SURE...IF IT'S

Westinghouse



CREOSOTE

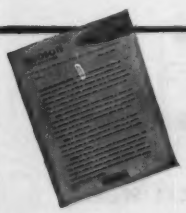
. . . the modern preservative with a proved record

Secrets of 63-year pole life unlocked in laboratory

The 63-year old English telephone pole which Koppers Tar Products Division representatives brought to this country recently was an outstanding example of the long service which only pressure-creosoted wood can document. Intensive laboratory investigations have been conducted on this pole to determine, among other properties, its retention of preservative and the chemical composition of the creosote used in its treatment.

Preliminary findings are now available . . . and infra-red spectrophotometer comparisons of modern creosote with creosote extracted from the old pole tell a dramatic story! As you will note from the spectra in our illustration, the creosote which protected this Scots pine pole for 63 years is practically identical with today's creosote.

One conclusion is obvious: the creosote treatment you specify for your wood investment today will give the same long life as that typified by the 63-year record of the English pole. What better evidence that creosote is, truly, the 50-year-plus preservative.



To keep abreast of news on wood preservation, you'll want to receive these periodical reports on Creosote. Just drop us a note and we'll put you on the mailing list.

KOPPERS

CREOSOTE

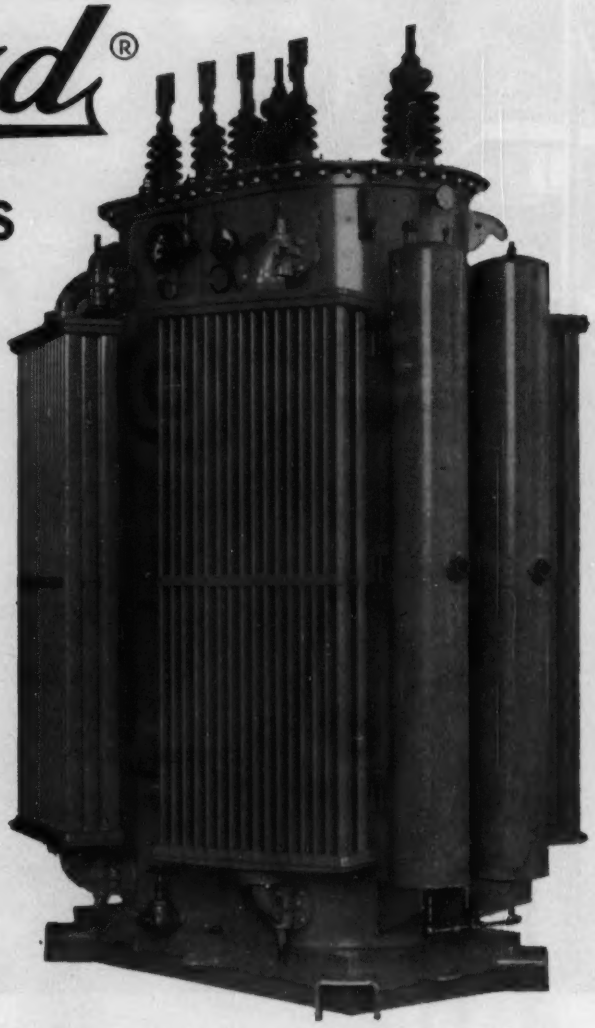
TAR PRODUCTS DIVISION

Pittsburgh 19, Pa.

Standard®

POWER TRANSFORMERS

efficient . . .
economical . . .
dependable



2500 KVA, single-phase, OISC power transformer, 34,500 volts primary, 2400x4800 volts secondary. Special design to meet customer's specifications. Standard engineers will work with you to meet your requirements.

● Where power requirements demand above-average reliability and efficiency, Standard Power Transformers are your one best choice. Figures taken from service records show how Standard's sound engineering principles cut maintenance costs to the bone and boost transformer life.

Standard engineers work with your engineers to incorporate the transformer design features and specific components that meet your needs most efficiently. Bushings, tanks, finishes, covers, and accessories meet ASA specifications and are rigidly inspected by Standard. Each transformer, regardless of size, is subjected to all standard commercial tests—both during and after manufacture.

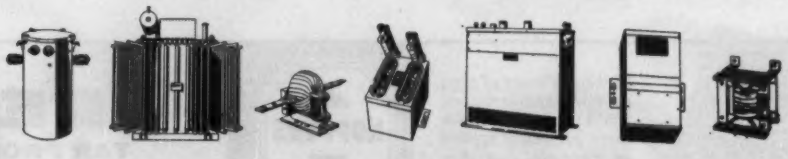
We can build transformers to your specifications as quickly and economically as if you'd bought repetitive designs.

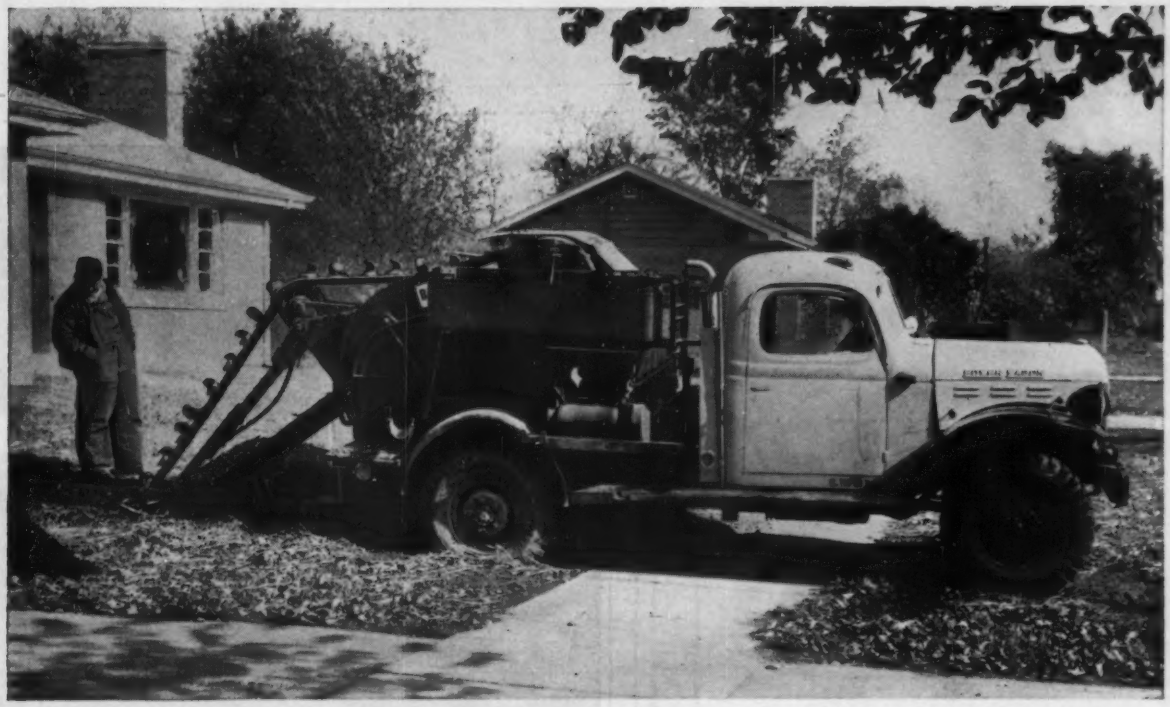
There's a Standard Transformer representative near you. Call him. He'll work with you to produce the best transformers you've ever used.

THE STANDARD TRANSFORMER CO. Standard®

WARREN, OHIO
REPRESENTATIVES IN PRINCIPAL CITIES

Transformers
FOR EVERY APPLICATION





100,000 feet of trench in eight months on scattered jobs—that's what a Barber-Greene ditcher delivered for a Midwest utility company.

12 Barber-Greene ditchers travel 800 miles ... dig 100 jobs daily

To speed up house service installation, a Midwest utility, name upon request, bought three Barber-Greene Model 711 Ditchers. These ditchers paid off so well that nine more similar units with variations in boom design were soon added to meet the growing need for fast service trenching in the 250 different communities served by this progressive utility. This fleet of 12 has dug over 625,000 feet of trench in less than a year. As a result of this performance record, four more of these versatile ditchers have been added to the line—boosting the total to 16.

Here are some of the features of the Barber-Greene Model 711 . . .

Unmatched mobility: Rubber-tired mounting provides fast job-to-job travel. Easy to drive, this Barber-Greene cruises at 45 m.p.h. . . . shrinks distances between jobs.

One-man operation: Once on the job, the operator merely lowers the boom and starts digging. Hydra-Crowd control permits infinite range of digging speeds from 0-13 feet per min.

Greater traction: . . . with four-wheel drive. An important feature when digging on slopes and hillsides or on soft, muddy ground that often surrounds new housing projects.

Saves lawns and curbing: Low bearing pressure and proper weight distribution offer real protection to lawns, sidewalks and curbing. Low height prevents entanglement with trees.

This is just one of five different Barber-Greene ditchers, each designed to cut costs on a wide variety of jobs.

Write for literature on the ditcher that saves time on the job and on the road.

56-18-D

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

THERE ARE NO CLOSED

. . . DOORS AT MOLONEY

Moloney's doors are literally never closed to your transformer problems. No matter how trifling . . . no matter how important, Moloney is always pleased to assist, when asked, in helping you solve the transformer problems that frequently occur.

You can depend on Moloney for competent assistance,

based not on the premise to sell, but instead on the preferred premise to render a helping hand . . . backed by 60 years experience in designing and fabricating better transformers.

M-E55-50

Specify Moloney . . . Get Dependability at its Best

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers Industrial Dry Type Transformers • Capacitors • Magnetic Components for Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONT., CANADA

"I Am Ambitious Of Your Esteem"

Captain John Paul Jones:

To the Countess of Selkirk, in 1778, Paul Jones wrote ". . . I am ambitious of your esteem and friendship, and would do anything, consistent with my duty, to merit it."

After his men of the "Ranger" had commandeered the Selkirk's silver, Jones had privately promised to return it. Buying it from his crew for 140 English pounds, he returned the silver to the Countess in 1784. The Captain kept his word and won her lifelong esteem.

For more than a century, Kerite has been ambitious of your esteem—by building the most lasting cable yet known. And more than three generations of Kerite craftsmen have given of their inherited skill and craftsmanship to assure the long life and service of Kerite Cable. The Kerite Cable Company takes pride in the fact that their product is chosen by buyers of integrity to safeguard installations around the world.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

KERITE CABLE

Founded 1854

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston;
4101 San Jacinto, Houston 4, Texas; 1010 Euclid Avenue, Cleveland 17, Ohio;
29 West Lancaster Avenue, Ardmore, Pa.

EDITORIALS

Water for Farms, an Industry Challenge

We Americans are constantly reminding and praising ourselves about our "highest standard of living in the world." Indeed, some of us become so preoccupied with our achievements that we forget or overlook what is yet to be done.

But there is much to be done . . . and in fields in which we consider ourselves rather far advanced.

Take the mundane matter of running water.

It seems absurd, almost impossible, that in mid-twentieth century America we should have to think about it. After all, isn't it a little like talking about enough air? Doesn't everyone have it? The answer, which may come as a surprise to many, is a definite, emphatic NO!

In the United States today there are more than a million and a half farms that do not have running water. Add to this another several million non-farm rural homes without it. Multiply this by the average number of people in the rural family, and you get a sizeable part of our population without this living facility that most of us consider a necessity.

So what? What does this have to do with the electrical industry? Where do we fit into this picture?

The answer, of course, is right in the middle. The promotion of pressure water systems on farms where they do not now exist or are inadequate is a job that can and should be done by this country's electrical industry. Everyone involved stands to benefit from such a promotion. Here's how:

- The American farmer is faced with a Malthusian problem: The number of farms is decreasing, but the nation's population is going up faster all the time. So he must clothe and feed more people every year. Increased productivity is what he has to have. More complete farm electrification, including an electrical water system, is the answer.
- The manufacturer stands to gain in the simplest way: He'll sell more pumps, motors, piping, switches, and everything else that goes into such a water supply system.
- The power company—and this is of primary importance with regard to rural sales—is going to sell more kilowatt-hours.

There is still another consideration. Perhaps because it is so new it has been overlooked. The promotion of a running water system on farms for both living and working provides the perfect cornerstone around which private utilities, co-ops, and manufacturers can build their Farm Better . . . Electrically Programs.

The key to electric brooding, space conditioning of farm buildings, soil electrification, and the myriad of other uses for electricity on the farm may well be hidden in the faucet.

Put More Security in Service Deposits!

Let's face it! There always has been and probably always will be customers who resist paying their electric bills till the last minute, and there always will be some who move out of town leaving unpaid bills.

These "floaters" account for a substantial and growing number of dollars charged off by utilities each year. The 77 electric and gas companies participating in a survey reported at the National Conference of Electric and Gas Utility Accountants had a net charge-off of $11 million in 1956, up nearly 19% over 1955. Moreover, funds charged off are increasing at a substantially faster rate than total kilowatt hour sales.

Security deposits have for years been the means of reducing the charge-off impact. But with today's widespread bi-monthly billing practice the transient customer can accumulate charges for 3½ months or more of service, worth twice as much as his deposit.

As long as utilities do collect deposits, it seems logical in the face of mounting charge-offs and extended billing periods that they consider revisions which would fix more realistic sums where credit risks are doubtful. Certainly such an increase in the size of security deposits is a logical one that is fair to the customer and the company.

Line Contractors Shift into High Gear

DISTRIBUTION WORK has become large part of the business in past decade

Here's a peek at how contractors work, how they recruit men, how they complement your regular working crews, and some of their problems. Some 500 contractors will do $100 million business for utilities this year. In distribution field, they're the "Men Who Came to Dinner" and stayed on and on

Electrical line contractors will tell you that their work is not nearly as seasonal as it used to be. Yet, they like to get a big job started about this time of year—with the best working weather ahead.

Out in Idaho a contractor teamed up with Idaho Power to begin work this month on a $4.5 million transmission line project.

In the Midwest another contractor began work recently on a 90 mile, 345 kv line linking Commonwealth Edison Co system with the American Gas & Electric Co system.

In upper New York State still another contractor is starting work on lines that will tie in the St. Lawrence project with surrounding systems.

And all over the country line contractors large and small are shifting into high gear on all sorts of distribution work to take advantage of the fine working weather.

Do More Distribution Work

There is scarcely an electric utility in the country that does not make some use of the contractors' services. Contractors have always—or at least since the breakup of holding companies—done the bulk of transmission construction. But since World War II, they have been doing an ever increasing amount of distribution construction and maintenance.

"The utilities brought us in to help them through the big post-war building surge," one contractor comments. "But they've found that the surge is still going after ten years." In the distribution field, the contractors are something like the "Man Who Came to Dinner." But unlike the man in the play, they have received a royal welcome from their hosts.

One contractor who entered the business in 1947 did about $30,000 worth of sales in the first year. His gross revenue for 1956 had zoomed to $8½ million. His heavy load of distribution work has made him one of the five or six largest contractors in the business. Rough estimate as to the total line construction work done last year runs around $100 million. The large number of contractors (an estimated 500) makes it impossible to get an accurate picture of the utility work being done by them. Many of these are small one- or two-crew firms that work in their own local area.

Basically there hasn't been much change in the services offered by line contractors over the years. They furnish the men and the tools. Utilities furnish the materials and pay for the services. But due to personnel shortages in utilities or the desire of utilities to maintain minimum working forces, contractors have been extending the range of their services. When called on, the contractors will help obtain rights-of-

Tips On Contracting

Line contractors offer these suggestions to utilities:

1. Get to know the contractors that serve your area. A list of those available will come in handy during an emergency.
2. You can help build a better, more dependable contracting force by offering year-round work.
3. Make sure that rights-of-way and other matters have been cleared before you give contractors the go-ahead on a job.
4. Cost-plus contracts may save you money over set-price contracts if you select dependable firm.

for Busy Season Ahead

way or help work out rights-of-way problems. They can and do take on distribution maintenance jobs, install service drops, even put up meters.

Some utilities contract for four or five distribution crews and assign work to them on a regular year-round basis. These crews handle all types of work usually encountered by regular utility crews.

Transmission construction, however, is still handled generally on a package job basis, for which bids are invited. These are the "big" jobs that contractors vie for and brag about. They often run $1 million or more and pose the big risks and potentially the more handsome profits in a highly competitive business.

In making a sales pitch to utilities, contractors point out these advantages:

- Contractors can provide a much more flexible work force than a utility could possibly afford to build within its own organization.
- Utilities are given a fixed price or cost plus contract which covers all supervisory, insurance and other responsibilities.
- Utilities get an efficient work force which might be used as a yardstick to measure the effectiveness of their own crews and methods.
- Utilities may, at a few hours notice, call in a large, organized force for use in emergencies, such as hurricanes, floods, and tornadoes.

One mid-western contractor puts it like this: "We can do any kind of a job and do it as well and as cheap as the utility can do it."

Others put it less bluntly, but most are proud of both the quality of their work and the efficiency of their crews. You get the feeling they would really like to match some costs with regular utility crews. But they claim that utility accounting makes it very difficult to draw the comparison. For instance, they say, that some utility overhead and supervisory costs just aren't counted in when comparisons have been made.

Most of the larger contractors employ strictly union men—generally members of the International Brotherhood of Electrical Workers. Bargaining is sometimes carried on a regional rather than purely local basis because of the wide-ranging activities of the contractors.

TRANSMISSION CONSTRUCTION has glamor for large contractors, some of whom shun distribution work. These are the "big" jobs with risks and profits to match

IBEW gives the contractors a helping hand in recruiting workers for a particular job. Local union business agents keep tabs on members, know the ones that are seeking other jobs. A visit or call to these agents is one quick way of rounding up recruits.

If a contractor needs to increase his working force quickly for a new or emergency job, he's likely to send a couple of men out "bird-dogging" for recruits. These men usually are able to offer attractive salaries to linemen—salaries that may occasionally snare a utility lineman or a lineman from another contractor. But contractors will tell you with a beguiling smile that they "frown upon the pirating of linemen."

If you look at their sales sheets for the first few months of this year, you'd see that contractors' business is running as much as 10% ahead of the same period last year. There's a chance that this will be another record year for them. But they eye the declining housing starts and wonder whether the distribution work will keep pace with that of some years in the past.

Indiana Utilities Score G&T Co-op Move

Say $45-million plant is not needed. But G&T spokesman asserts it is—to meet future co-op power requirements at "reasonable rates"

Indiana's private utilities are digging in for what may become a desperate struggle to keep a generating-and-transmission group of nine co-operatives from building a $45-million steam plant and 900 miles of transmission lines which, as proposed, would serve an aluminum plant as well as the nine member co-ops.

Hoosier Energy Co-Operative, Inc, Shelbyville, Ind., already has applied for a $42-million federal REA loan. The $3-million balance reportedly will come from "other sources"—rumored in Washington to be Roy Richards and Associates, Inc, of Carrollton, Ga. Richards has written a letter of intent to REA to lease the generating plant from the co-ops and to take a steady 55,000 kw at his proposed aluminum plant 55 miles away in Kentucky.

Utilities Attack Proposal

R. A. Gallagher, president of Public Service Co of Indiana, said, "The proposed plant is an effort to use government funds for co-operatives to carry on a business enterprise and sell power to an industry or industries.

"Indiana power companies have done a good job of providing electric service at a fair price, and have paid their full share of federal and state taxes."

A. D. Brown, president of Southern Indiana Gas & Electric Co branded the co-op move as "creeping socialism," and said "it is coming without full knowledge of voters or taxpayers."

"We don't like an agency of the government, that's designed to provide farm service, changing its concept into one of area development," he said.

"This would be an industrial development subsidized by the taxpayer. We have been trying to contain TVA—and now the bureaucrats come along with this proposition that's just as bad.

"We understand Richards is going to build a co-op's line with a 2% government loan. This is a form of competition that tax-paying utilities can't meet. The only way we can beat it is to stop it with public opinion. Apparently Mr Benson is going into the business of socialized power for industry."

Co-op Spokesman Defends Plan

Frank Ratts, mayor of Osgood, Ind., and Osgood REMC manager, asserts as co-ordinator for Hoosier Energy that the plant is needed "to meet future power requirements of the nine REMC distribution systems at reasonable rates."

In Indiana, rumor has it that Richards, who would operate the plant, would sell power to the co-operatives at 4½ mills at the plant bus.

Fixed charges on Hoosier Energy's transmission lines reportedly would make delivery cost somewhat lower than now paid by REMC units to private companies.

Private power company spokesmen say the co-op plant is not needed, that ample supplies always have been provided to the rural distribution systems, and there never has been a shortage in Indiana.

Rhetorical Gunslinging . . .

. . . characterizes recent Western States Water & Power conference as federal and private power advocates plug each other with verbal volleys

Rhetorical gun shots riddled a recent Western States Water and Power conference in Salt Lake City as federal and private power advocates stalked the evils of the other's theory of power resources development.

Billed as a level-headed conference, the meeting opened with a shot from the hip by James Patton, head of National Farmers Union, Denver, Colo. He said partnership is a "fraud on the taxpayers." The Hells Canyon development by Idaho Power is "compound grand larceny" which permits the "public to do the paying and the private company to do the profiting."

Patton attacked the amortization certificate granted Idaho Power by the Office of Defense Mobilization as an "indefensible" means by which the utility is "granted public money to help carry away its loot."

Sen Wayne Morse (D-Ore.) continues to see the federal Hells Canyon program as a "symbol" which if destroyed "will permit Idaho Power to under-develop a great public resource for a quick profit," he said.

But E. M. Naughton, president of Utah Power & Light, termed governmental ventures—such as TVA, Bonneville and certain REA programs— as "electric yardsticks with elastic proportions."

They provide a means by which the government takes money from one segment of the people to help another. This, he said, is either "legal plunder or socialism."

Sen Arthur V. Watkins (R-Utah) cited Hells Canyon as a symbol of the partnership program—a plan that has as its basis the Lincoln theory that government should only do for the people what they cannot do themselves.

Utah's Republican Gov George D. Clyde defended the Eisenhower program as the "best means" yet devised to carry out multiple water and power site development. He added that the federal government in its recognition of overall basin-type water resource development "makes the partnership problem easier and greatly assists in solving the problem of river regulation."

Is Stalemate on Civilian Atomic Power Ending?

Reactor development program, checked for two years by Republican-Democrat conflict over federal participation, may soon move ahead under a compromise plan

The Congressional chess game over the direction this country's civilian atomic power program should take saw new moves last week.

They all add up to this fact: there will be more government money put into atomic power development.

The precise formula still has to be worked out. But the Democrats, favoring federal construction of reactors to supplement industry's efforts, and the Republicans, at first completely opposed to any federal construction, now are not far apart.

Both Parties Modify Stands

Democrats at one time were wedded to the Gore bill which called for a $400 million program of federal reactor construction. Recently they have backed down to the extent that they would accept about 30% of their original demands.

The Republicans, who originally wanted no federal construction, now appear willing to support a bill sponsored by Rep James E. Van Zandt (R-Pa.) proposing a $100-million small-scale federal reactor construction program.

Added to the foregoing was the recent statement by the Joint Committee on Atomic Energy chairman, Rep Carl T. Durham. He has urged that consideration be given to adopting a long-range program of assistance for atomic power development.

Durham favors a 10-year program of both government and industry guarantees of financial support for atomic power projects. Such a program, he feels, would carry atomic power development through the lean years to the point where it begins to pay off for its sponsors. The program would guarantee a continuing effort at a time when the reality of atomic power development costs might discourage many potential builders.

Van Zandt hopes his bill will provide a possible basis for compromise between the two sides. His proposal would also eliminate the potential difficulties raised by Rep Clarence Cannon (D-Mo.), House Appropriations Committee chairman, who has questioned the legality of AEC's financial assistance to private industry projects (EW, April 29, p 86).

Van Zandt's Bill Outlined

Under Van Zandt's measure, the Atomic Energy Act of 1954 would be amended by adding a new chapter containing the following provisions:

- AEC would be given additional statutory authorization to enter into research and development contracts for large-scale power reactors with private industry.
- AEC would be authorized to undertake a $100-million program of advanced design reactor development. Under this plan, all reactors would have a capacity of 50,000-kw or under and would be at AEC sites with AEC using any power generated.
- AEC must make public full details of financial assistance granted for research and development.
- After 15 years of operation, AEC must sell to the highest bidder any reactors it has constructed.
- Commercial atomic power projects, and others, would be defined as "emergency facilities" eligible for rapid tax amortization deductions.

Unquestionably, this last item will meet with Democrat opposition.

But Van Zandt argues that since construction of atomic power reactors has been demonstrated as unprofitable and uneconomical and "since the national interest requires accelerated effort in this field, it seems clear to me this limited tax relief is justifiable and in the public interest."

REP JAMES E. VAN ZANDT

The Van Zandt bill is significant from two points of view.

First, it acknowledges the need for acceleration of the reactor program. While saying the present program will meet this country's needs for economic atomic power in time, Van Zandt adds that "for noneconomic reasons of national prestige in the eyes of the world there is need for us to maintain and extend our world leadership in atomic affairs." This, he contends, need not be done in terms of installed kilowatts but by broadening the technological base.

Second, Van Zandt represents a coal mining district and coal interests last year contributed greatly to killing the Gore bill in Congress. Now the coal industry apparently is willing to go along with a limited federal reactor construction program.

Appropriations May Be Affected

The apparent closing of the gap of Democrat and Republican thinking could bear fruit not in the form of either an amended Gore bill or an amended Van Zandt bill, but in the appropriations bill.

JCAE wrested with this measure in closed sessions all last week. This could provide the ground for compromise that will lift the air of uncertainty that has hung over the atomic power program for the past two years.

Florida Reactor to Use Natural Uranium

Three Sunshine State utilities ask AEC for certain research and development help, and a waiver of fuel-use charges for first 5 years of operation

The nation's first large-scale nuclear power plant using natural uranium as its fuel has been proposed formally by Florida Nuclear Power Group.

In announcing receipt of the application, the Atomic Energy Commission said the proposal requests that the Commission lend help in certain research and development areas, and that it waive fuel-use charges for a five-year period. This period would begin when the plant is licensed to operate.

The Commission also pointed out that it will not grant an operating license until rigid safety standards have been "fully complied with."

Florida Nuclear Power Group submitted the proposal on behalf of Florida Power Corp, Florida Power & Light Co, and Tampa Electric Co. It is a response to AEC's third invitation issued Jan. 7, 1957.

Design to Start Soon

General Nuclear Engineering Corp, headed by Dr Walter H. Zinn —a former director of AEC's Argonne National Laboratory, has been engaged to design the reactor and carry out the research and development work. This includes development of the natural uranium fuel elements.

The nuclear-plant plan calls for a heavy water moderated, gas cooled reactor. The plant is to have a net electrical capacity of 136 Mw.

Preliminary estimates fix its cost at about $40 million. Under conditions of the AEC's third-round invitation, the plant is to be completed not later than June 30, 1962.

Strauss Praises Move

AEC's Chairman Lewis L. Strauss has commented favorably on the Florida group's proposal:

"It is gratifying," he said, "that the first proposal submitted in response to the Commission's invitation of Jan. 7 should be for one of these two important types."

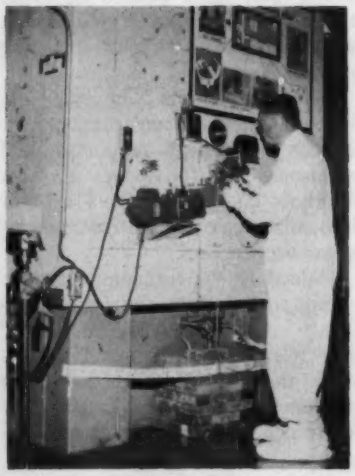
(The second type to which he referred, and which AEC hopes industry will propose, is a power reactor fueled by aqueous solutions or slurries of uranium or of uranium and thorium-bearing materials.)

NUCLEAR NOTES

Construction of Dresden Nuclear Power Station for Commonwealth Edison Co is to begin in early June, the company reports. Ground-clearance and excavation work has been going on for several months, and also construction of the big steel reactor containment sphere.

Potentially serious accidents involving material licensed by the Atomic Energy Commission must be reported "promptly" under an AEC amendment to its regulation on standards for protection of workers and the public. A detailed report must be filed within 30 days covering all incidents of radiation exposures or concentrations of radioactive materials above permissible limits.

First American-built reactor for Europe has gone critical in Amsterdam, The Netherlands. It is a 10-kw pool-type research reactor designed by AMF Atomics, a division of American Machine & Foundry Co.



Here's What They Wear . . .

. . . in Scotland

W. L. Jones, shown here, is a safety foreman at the Dounreay Experimental Reactor for Industrial Nuclear Power in North Scotland. Wearing this pressurized suit, he's testing valves supposedly contaminated by a hypothetical fall-out of radioactive material.

. . . in the United States

Wearing a different kind of protective clothing, a scientist at the Hanford Atomic Energy Plant near Richland, Wash., operates from the outside a polishing grinder inside a metallurgy cell to prepare radioactive metal for further experimental testing.

Operating Expense—or Not?

Is insurance against heavy steam generation in low-water years an allowable operating expense? This is what Oregon Public Utilities Commissioner Howard Morgan intends to find out in a study of the $500,000 annual premium paid jointly by three Pacific Northwest utilities.

Preliminary inquiry has raised doubts, he said, whether the policy would protect power users against surcharges, should heavy steam generation be required in a low-water year. In the winter of 1952-53, Oregon PUC allowed Portland General Electric and Pacific Power & Light Cos a 20% surcharge to recover heavy steam generation costs.

The policy, taken out last winter with Lloyds of London by Pacific P&L, PGE, and Washington Water Power Co, provides that the first $1.5 million steam costs must be borne by the companies and is not recoverable. Beyond that, Lloyds would pay not actual steam costs, but a sum based on deficit of water flow under median flow.

"The rate payers are entitled to know whether this affords solid protection against another surcharge, and whether it constitutes an allowable charge against operating expense," said Morgan. "It is up to my office to find out."

Paul B. McKee, Pacific P&L's president, said his company's operations are constantly open to Morgan's scrutiny, being a regulated public utility.

Cautious Optimism

The U. S. Weather Bureau has expressed what it terms "cautious, but perhaps justified" optimism that the five-year drought in the great central and southern plains may have ended. Some areas of these sections already have had more rain this year than all of last. Still, the Weather Bureau said, "no one can say with assurance that the widespread drought has finally ended."

Still to Be Solved

After a car loaded with coeds from Punahou Academy in Honolulu crashed into a utility pole, the coroner's autopsy found that two of the three girls killed had been electrocuted.

The tragedy brought a letter to the editor of the Honolulu "Star-Bulletin" asking if there are not "instant, automatic, and fool-proof cut-off switches" available to thwart such mishaps.

Leslie A. Hicks, president of Hawaiian Electric Co, wrote a reply, saying his firm has the most modern electrical devices made. "The letter," he wrote, "brings up a problem . . . now being studied by electrical engineers throughout the world. There have been tremendous improvements made in the electrical and electronics fields," he wrote, "but there is still no device made that will interrupt the flow of electricity when a wire is broken."

$144,000 Saving—Daily

William C. Latham, N. Y. State Power Authority resident engineer at Niagara Falls, is overseeing preliminary planning of the State's development of hydroelectric power at Niagara Falls. He says that every day his group can save in construction time of the project means a $144,000 saving. Ontario Hydro, he points out, is now using the U. S. share of Niagara River water allocated for power production. That's worth about $100 a minute, he said.

A Public Compliment

A $576,500 Puget Sound Power & Light Co brush-cutting program last year is paying off in public relations as well as service continuity. A letter to the Seattle "Post-Intelligencer" said, in part: "I want to thank Puget Sound P&L . . . for its enlightened policy, effort and expenditures . . . to beautify our highways and rural roads. This is a commendable project of the company. . . ." The brush-cutting program, begun five years ago, is done 50% under contract and 50% by company crews using six chippers, ladder trucks, and other equipment.

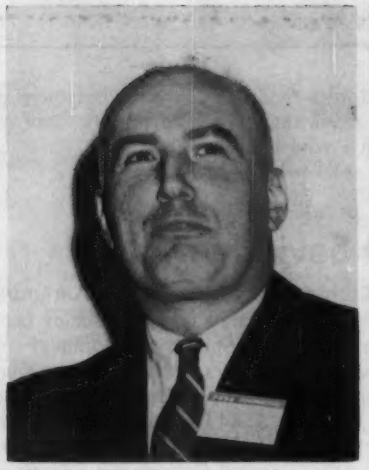
Fast Cable-Laying

San Diego Gas & Electric Co has laid a fifth 3,900-ft cable across San Diego Bay, running from the city to Coronado. The job was done in ½ hr. Object was to improve electric service to Coronado, where major Navy installations are situated and where extensive residential activity is under way.

Of the four existing cables, two are of the same size and two are smaller. The new power link is a 12,000-v, three-conductor, 500,000-CM cable. It is rubber-insulated, and has steel armor on the outside. About 4½ in. in diam, it weighs about 20 lb a foot, and will carry about 7,000 kw. This project cost $100,000.

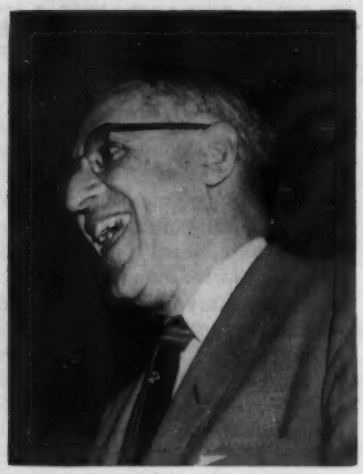
Three Not-So-Little Words

An agreement on Niagara power development legislation in Washington now seems to hinge entirely on three words: "Economic transmission distance," it was reported at EW's deadline. One faction holds this distance to be 150 miles, but another says it should be 300.



"BRAINSTORM" for useful ideas, says Philip Carling, advertising man

MOTIVATION RESEARCH will aid your advertising, says Virginia Miles



"UPGRADE YOUR ACTIVITIES" urges EEI President Donald S. Kennedy

It's TV vs. Newspapers at PUAA

Annual meeting hears report on motivation study, gets tips on "brainstorming." Guaranty Trust and 94 utilities receive advertising merit awards

Television squared off against newspapers for utility advertising in the only sign of a scrap at the recent Public Utility Advertising Association convention in Cleveland.

Besides viewing the wild punches in the TV-newspaper tiff, some 200 PUAA members present also:

- Heard results of motivation studies which dug into public attitudes toward utilities.
- Received instructions for conducting "brainstorming" sessions.
- Heard plea from Edison Electric Institute President Donald S. Kennedy to "educate your bosses about the importance of your jobs."
- Advanced Richard D. Furber, Northern States Power Co, to the post of PUAA president; elected Sam A. LaFaso, Jersey Central Power & Light Co, secretary of the organization.
- Witnessed presentation of 189 awards for outstanding advertising efforts.

TV, Newspaper Virtues Cited

A hard-hitting bid for more utility advertising was made by President Norman E. Cash and Vice President Eugene Accas of the Television Bureau. The presentation purported to show that TV offers the most effective form of advertising for utilities as well as for other industries and manufacturers. Cash and Accas hit hard at other advertising media — particularly radio and newspapers—as being relatively ineffective compared with TV.

Rebuttal came in the form of a slickly-produced, full-color film, "People, Profits, and You," presented by the American Newspaper Publishers Association. The theme was, "All business is local and so are all newspapers." It was a colorful, low-pressure bid for more newspaper advertising.

Motivation Studies Praised

As the basis for any friend-winning advertising, Dr Viriginia Miles of McCann Erickson Advertising Agency suggested the use of motivation studies. Such studies conducted bv Dr Miles indicate that utility customers tend to think that suppliers of gas and electricity are related to monopolies and the customer is helpless in dealing with them. Customers—some of them at least—look on the monthly utility bill as a waste of money. They think utility services should be free, or provided as a part of other community services.

Use of the motivation findings have been used successfully to direct utility advertising toward overcoming some of the normal resentment, Dr Miles reported.

Try Brainstorming Ideas

To create advertising ideas, Philip C. Carling of Batten, Barton, Durstine & Osborn urged use of the "brainstorming" technique. For a successful "brainstorming" session, all critical judgment is ruled as a group gets together to produce a large quantity of ideas on a single problem. Carling described the technique and its applications as applied at BBD&O.

EEI President Kennedy told the advertising men that electric utilities have made less progress in the fields of sales, customer acceptance, and political acceptance than in any other fields. "You must sell yourselves and your jobs to your own management," said Kennedy. "You must give more attention to selective selling as a means of improving the declining load factors that many companies are experiencing," he concluded.

Awards for outstanding advertising efforts were presented to one banking firm and 94 utility companies at the PUAA meet. Every phase of advertising conducted by

investor owned operating utilities was judged in the contest.

Special award went to Guaranty Trust Co of New York for its ad editorial, "The Real Giveaway." It was judged "outstanding advertising published in support of private enterprise in the public utility industry."

Awards Presented

From the 2,080 entries by utilities, 189 were judged as outstanding and given awards.

Leading the winners in number of awards received was Northern States Power Co, Minneapolis, which received seven. Consolidated Edison Co of New York was second with six awards.

Seven companies — Cincinnati Gas & Electric Co; Cleveland Electric Illuminating Co, East Ohio Gas Co, Cleveland; Laclede Gas Co, St. Louis; Pacific Gas & Electric Co, San Francisco; South Jersey Gas Co, Atlantic City; and Wisconsin Public Service Corp, Green Bay —each received five awards.

Six companies — Commonwealth Edison Co, Chicago; Hartford Gas Co, Hartford, Conn.; Houston Natural Gas Corp, Houston; Indianapolis Water Co; Southern Union Gas Co, Dallas; and Virginia Electric & Power Co, Richmond—received four awards each.

Three awards were received by British Columbia Electric Co., Ltd, Vancouver; Connecticut Light & Power Co, Hartford; Hartford Electric Light Co, Hartford, Conn.; The Hawaiian Electric Co, Ltd, Honolulu; Minneapolis Gas Co; New Orleans Public Service, Inc; Texas Eastern Transmission Corp, Shreveport; Union Electric Co, St. Louis; and Washington Water Power Co, Spokane.

Twenty companies picked up two awards each, and 50 companies received one each.

All winning entries have been reproduced in the 1957 Better Copy Contest Awards Blue Book. Copies may be purchased by contacting Frank C. Lietz, chairman of the Better Copy Contest, Northern Illinois Gas Co, Bellwood, Illinois.

New officers: George W. Kindon, Philadelphia Electric, first vice president; Warren W. Widenhofer, Indiana & Michigan Electric, second vice president; F. C. Lietz, Northern Illinois Gas, third vice president.

Spouting-Type Stack (right) Is Taller Than It Really Is

By spouting waste gases skyward at 60 mph, Niagara Mohawk Power Corp's new, as-yet-unfinished exhaust stack at its Huntley Station will scatter the stack emission an effective 50 ft above its actual 350-ft height.

This unusual stack is to handle gases from two reheat boilers associated with two 200-Mw generating units now under construction, the company reports.

The high-velocity discharge feature means that gases (already stripped of fly ash by dust collectors) will be dispersed more than 400 ft above ground. "This is a long step forward in elimination of ground contaminating gases," the company states.

Based on Model Data

Construction of the stack followed preliminary research conducted at New York University's wind tunnel, where a scale model of the 800-Mw Huntley Station was checked. Test data, combined with economic advantages promised by a single stack for the two new generating units, led to the high-velocity-discharge design.

The top 15 ft of the stack, when completed, will consist of three 8-ft, 10-in. steel tubes. Two of these tubes will be equipped with motor-driven dampers, to be operated from the plant's central control room. By regulating the dampers plant personnel will be able to maintain the forced exhaust of gases at as low as one-third of capacity.

The stack's main shaft is built of reinforced concrete lined on the inside with brick. It has a 30-ft outside diameter at the bottom and a 21-ft top diameter.

Has Fly Ash Facilities

A 500-ton fly ash storage bin with an equipment floor below it for unloading the waste into cars or trucks, will be built into the stack's lower section below the breeching opening (where flue gases enter the stack). A collecting room, for venting purposes, will be above the bin. Both equipment and collector room will be accessible via walkways from the boiler house. Fly ash will be carried to the bin pneumatically from dust collectors of the two boilers now being built, and from other boiler units now in service.

The new generators for the Huntley Station, now undergoing a $60-million expansion, will be of cross-compound design. The high-pressure unit will operate at 3,600 rpm, low-pressure at 1,800 rpm. First unit is slated for service this fall, and the second a year later. The stack will serve two reheat boilers, each rated 1.47 million pounds of steam an hour at 2,400 psi and 1,050/1,000F.

345-Kv Line To Cost $90,000/Mile

EEI T&D group hears Detroit Edison's double-circuit transmission line will start operating at 120 kv but will be extra-high voltage by 1975

The double-circuit, 345-kv, bundled-conductor transmission planned by Detroit Edison Co will cost about $90,000 per mile plus rights-of-way outlay, the Edison Electric Institute's Transmission and Distribution Committee was told at its May 1-3 meeting in Kansas City.

Lines at that voltage were decided on in view of future load requirements, economics, and the difficulty in obtaining space for expanding the present 120-kv system, said David Burns. He noted that public relations problems were also a factor.

The EHV lines, Burns said, will operate initially at 120-kv, changing upward as the capacity of generating stations exceed those of the 120-kv lines. This situation, he added, should develop about 1964, and all facilities at 345-kv will be needed about 1975.

Combinations Compared

Twin bundled conductors have less inductive reactance and radio interference, but considerably greater impedance loading than single conductors, said R. B. Patrick and A. C. Verock. They reported a Commonwealth Associates, Inc., study of designs for EHV lines which compared 40 combinations of conductors. These studies, they said, showed that tower arm length can be reduced by restraining the center string of insulators.

J. B. Hodtum, Allis-Chalmers Mfg Co, stressed the importance of relating transformer losses to the hours a transformer operates at different loads. An understanding of the relationship between copper and core losses is also important, he said, pointing out that the present ratio is 3.3:1.

With the present design and considering this ratio as 100% cost, a change to 2.2:1 would make the cost about 105%, he pointed out.

Standing poles have been observed to lose much of their retention of pentachlorophenol and creosote, said F. A. Ashbaugh, arguing for a change in retention requirements.

Moved poles frequently decay rapidly through loss of preservative into the surrounding ground, he said. But he pointed out that bandages, supplying the necessary preservative, are available. He noted also that plans call for development of sampling method for determining the condition and preservative retention of 5 to 10 million treated poles in service 20 or more years.

Boring Costs Less

Boring facilitates the installation of underground equipment in congested areas, said J. Bogdanowski, Consolidated Edison Co, describing equipment for boring diameters from 1 to 30 in. Overall boring costs, he said, were 11% under those for open trench during the past two years.

R. E. Smith, Commonwealth Edison Co, and C. H. Elder, Illinois Bell Telephone Co, described the cooperation among the two utilities and housing project developers in the installation of underground power and telephone facilities. Costs, they said, were kept low when developers did some of the excavation, and the developers paid the difference in cost between overhead and underground facilities.

Smith reported that Commonwealth's buried primary cables amount to 600 miles. The newest underground project, he said, will have fiber glass vaults large enough for 100-kva transformers. Operating performance has been good and maintenance costs lower than for equivalent overhead facilities.

Gives Duct Advantages

R. C. Blankenberg said that Southern California Edison Co's residential underground facilities in ducts make maintenance and replacement easy.

Philadelphia Electric Co has realized appreciable savings in labor and transportation through use of time-delay fuses which have reduced "no-light" calls by 10 to 15%, reported J. W. Anderson.

Polyethylene tubing improves safety and appearance of transformer installations, reported Howard Diller, Central Illinois Public Service Co. Because of polyethylene's flexibility, the wires can be brought to desired points while covered. Costs are less for single-phase installations than for the previous design, and 3-phase installations cost no more, he said.

Kansas City Power & Light Co's accelerated conversion from 4 to 13.2 kv has resulted in a new distribution system, said H. A. Heim. The new system is cleaner and more able to meet load requirements, and costs have declined as the work progressed. The program will be limited now to removal of load from the 4-kv system.

The new "Underground Systems Reference Book" will be available about Aug. 1, it was reported by James Pulsford, Public Service Electric & Gas Co.

Army Engineers' Price 'Too Low' for Farmland

Plans for resisting efforts of the Army Corps of Engineers to buy property needed for the $168-million multipurpose Barkley high dam and lake for what they called "less than the fair value" are being formulated by residents of Kentucky's Lyon County.

A group of Eddyville and Kuttawa businessmen and farmers contended that prices offered by the Corps of Engineers were "far less than what the land is worth."

A county-wide meeting of landowners and residents who will be affected by the building of the dam will be held here soon.

NMP Builds Line

The Niagara Mohawk Power Corp is building a $6-million transmission line to Gardenville, N. Y., to handle power from new generating units being constructed at the Huntley Station.

Urges Aluminum Substations

NPPA speaker cites easier, cheaper fabrication; Tacoma meeting hears dc battery trips breakers advantageously

Fabricated aluminum costs less than equivalent galvanized steel for small substation structures, the Northwest Public Power Association was told at its April 23-24 Engineering and Operation Workshop at Tacoma, Wash.

Several manufacturers of aluminum alloy are extruding structural shapes that enable the engineer to design to exact values and requirements without the restriction dictated by standard steel sizes and shapes, said R. J. Pangborn, Cowlitz County PUD No. 1, Wash. Lighter weight makes handling, transportation, and installation easier, faster and cheaper. Compared with galvanized steel, he said, aluminum alloy has these advantages:

1. Economical fabrication by all the common processes.

2. Ease and speed of cutting with a portable power saw.

3. Ease of marking and drilling.

4. Availability in a wide range of shapes, sizes, forms, and alloys.

5. Attractive appearance.

6. Resistance to corrosion in contaminated atmospheres.

7. Excellent electrical conductance.

8. Non-magnetic structures allow terminating of single conductors within a closed structural box without power loss.

9. Resistance to permanent deformation from impact loads due to low modulus of elasticity.

10. Savings in erection time due to light weight.

11. Ease of making additions, alterations, or corrections.

12. High reclaim usage and scrap value.

A dc battery has definite advantages over capacitor trip devices for tripping circuit breakers in remote or unattended substations, said R. A. Harvie, Westinghouse Electric Corp.

It's easier to select batteries for size, he said, adding that the battery is preferable for its reliability and independence of system conditions and ambient temperatures. Although higher at first, its cost per breaker decreases as the breakers are increased to the point where, with three or four in the substation, first cost may be even less than that of capacitor trip units. The latter's single advantage lies in negligible maintenance.

Feeder Load Records Valuable

Feeder load records, according to R. C. Willis, Clark County PUD, are used chiefly for system planning. But recently they are increasingly used for supplying data for "predictions" and "probability curves," he said. A simplified method of plotting, correlation, and graphic presentation enhance their value and help justify their cost.

An NPPA committee to study the establishment of standards for voltage regulations, continuity of service, and flicker was urged by Quentin Mizer, Benton County PUD No. 1. The need for such standards, he said, has increased with the wider use of appliances in homes, business, industry, and on the farm.

R. S. Dole described the installation of a line-fault analyzer, consisting of a pulse generator and an oscilloscope, by the Clearwater Power Co. Installed at a total cost of about $2,500, it is expected to pay for itself quickly by cutting the cost of finding trouble and restoring service. Linemen, instructed in its use, are expected to be able to operate it soon.

Instruments Prove Versatile

Thermally-lagged indicating instruments afford year-round information of system conditions, said R. E. Kenyon, Sangamo Electric Co. Their use, he said, makes possible the prevention of outages and losses of system increments. Furthermore, they give the data for intelligent planning of system extensions or rebuilding, greatly simplify phase balancing and location of regulation, aid in determining compensation settings of the regulators and the coordination of transformer tap settings. Compared with recording meters, they have lower first and operating costs.

The compression joint increases contact points between inner and outer conductor strands, thus decreasing resistance, K. J. Lein, Cowlitz County PUD No. 1, told the NPPA. Pressure joints, he continued, do not apply such uniform, all-around contact, and all strands are not brought into equal circuit continuity and balance.

A 60-w microwave system was installed by Grant County PUD as temporary communications in the absence of telephone connections between the Ephrata dispatcher and a branch office, related Carl Johl.

Communication was possible over a mobile channel frequency of 158.13 mc because of reflection and bounce signals off the high rocky ridge along the west side of the Columbia River in the Priest Rapids area. It satisfied the need for a minimum of two telephone channels.

TVA to Serve Air Center with 4th Transmission Line

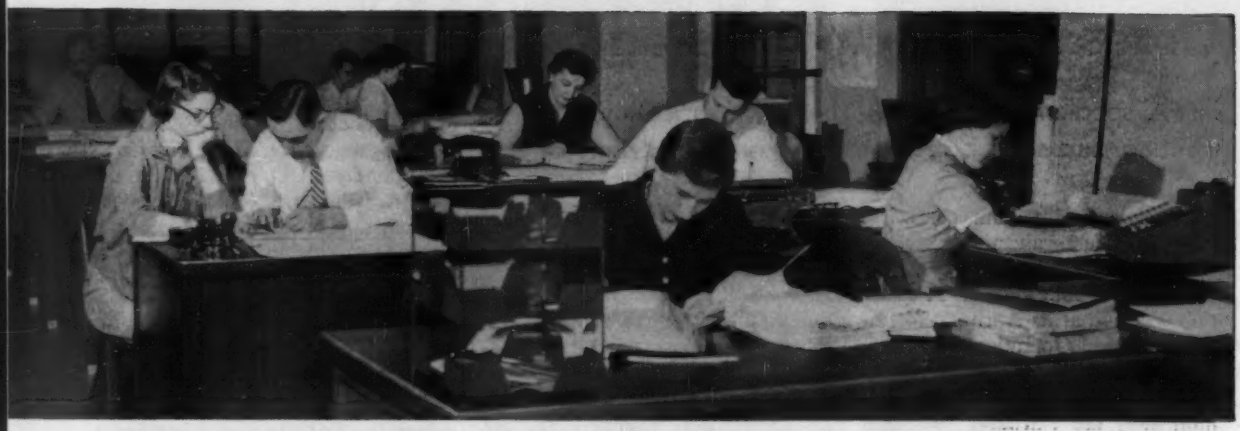
A fourth Tennessee Valley Authority power transmission line will be provided for the U. S. Air Force's Arnold Engineering Development Center this year, according to Maj. Gen. Troup Miller Jr, center commander.

The new line will provide a greater degree of reliability in the power supply for the wind tunnels and jet engine test cells of the Tullahoma, Tenn., center and make possible an increased flow of power for the motor drive equipment used in the operation of the center's facilities.

Each of the four lines represents a potential flow of approximately 125,000 kilowatts.

Japs to Export Generators

TOKYO (McGraw-Hill World News)—A contract for the export of electric generators and accompanying equipment to Burma under the Japan-Burma reparations agreement of 1954 has been signed by Burmese reparations officials and Japan's "Big Three" heavy electric machine makers—Hitachi, Tokyo Shibaura, and Mitsubishi Electric Manufacturing.



Consumers Power Saves Time and Money as . . .

Girl Clerks Ease Engineer Shortage

High school graduates with a flair for mathematics make simplified load and voltage studies with minimum supervision and do other routine work

F. C. FISHER, Executive Staff Assistant,
J. S. FRANCIS, Division Engineer, Consumers Power Co, Jackson, Mich.

To help relieve the shortage of engineers, Consumers Power Co trains female high school graduates to do many routine calculations and functions previously done by graduate engineers. We believe that concentration on selection and training of girls—and to some extent men, as available for technical duties—is the only solution to the present shortage of utility engineers.

Costs Cut As Output Increases

This use of technicians and clerks provides a method of increasing technical productivity and at the same time decreases over-all engineering costs. It also enhances the engineer's job by allocating routine tasks to others, permitting him to concentrate more on strictly engineering functions. It also provides a more flexible organization that allows for expansion and contraction of the work load.

The program began in 1948, when a male clerk was trained to tabulate data used by engineers in making load and voltage studies of primary distribution circuits.

Later, girls took his place. One was encouraged to try simpler calculations. As she had shown a flair for mathematics in her normal duties, she was tried on simplified load and voltage calculations. It was soon evident this particular employee was well qualified. Soon she was assigned more difficult tasks which she carried out equally as well.

With this as a background, a program was launched for training additional girls as technical clerks. The results have exceeded original expectations. Today seven engineers and five girls make all load and voltage studies required in planning for a distribution system of over 35,000 miles of circuit and 500 distribution substations. In addition, two engineers and one girl technical clerk make short-circuit studies for fuse coordination and flicker voltage studies. A seventh girl does much of the tabulation of data, filing, miscellaneous typing, and other office work.

To be a success, the employee must have a basic knowledge, interest, and ability in mathematics, even though elemental. Selection cannot be haphazard, but a carefully considered plan must be followed. Consumers begin with interviewers in the employment office who are acquainted with the job requirements.

Careful Screening a Must

Potential employees are tested in arithmetic, clerking, and typing. Those who show mathematical ability as well as other desirable characteristics are further screened by the engineering department. Of great importance also is the ability to "fit in" with her fellow engineering employees.

After she is hired, a probationary period as a filing clerk follows. By the end of this period her ability has been tested. If satisfactory she becomes a junior technical clerk. If satisfactory as an employee but not as a technician, she is transferred to a clerking job. Careful screening by the employment office is essential to success of the program.

Training period for each girl

varies, depending mostly on the individual. As practically all terms and methods are totally strange, the first few weeks are spent becoming acquainted with the various routines. Generally, the employee progresses through **1.** Miscellaneous filing, **2.** Work order processing, **3.** Map and record work, **4.** Tabulation of various load data, **5.** Translating data from graphic charts, and **6.** Preliminary sketches for one-line circuit drawings.

Distribution Planning Tools Follow

During this period, she is given opportunities to become acquainted with terminology and references used in distribution planning. With a sufficient understanding of these basic fundamentals, she is introduced to the method of primary load and voltage calculations. This is done under direct supervision of an engineer and starts with an actual sample voltage calculation.

First, an engineer tabulates data on a form, and the trainee carries out indicated calculations. At this stage she is introduced to fundamentals of the slide rule with which she performs simple multiplication and division. Gradually, the trainee advances to where she tabulates data required on the calculation form and completes the entire computation with nominal assistance from an engineer.

After sufficient experience in load and voltage studies of existing circuits, the girl is introduced to similar calculations in connection with minor circuit rearrangements. In time, a capable girl, under the supervision of a planning engineer, makes most of the routine calculations and circuit one-line drawings, and does other repetitive work previously done by an engineer.

Only Routine Check Required

At this stage, the technical clerk is a great help to the engineer. He makes only routine checks of the work as a study progresses. Special studies which occur frequently also can be carried out by the girl after the problem has been laid out by the engineer. Often variations in the original are made with the engineer merely describing what further information is desired.

A normal load and voltage study of existing circuits from a 1,500 or 2,500-kva substation takes 8 to 12 hours. Larger areas encompassing two to four substations take 16 to 40 hours. Studies on complicated circuit rearrangements require somewhat longer.

On the average, the technical clerk takes about ⅓ more time than an engineer to complete a routine study. This time lag shows up primarily in studies of rearrangements rather than in studies of existing circuit arrangements. Inability to recognize improper or undesirable routes, and the method of approach are two reasons for this.

Tabulation of data has long been a boring, tedious job to engineers. While this is true to some extent with feminine help, knowledge of the operation tends to make her more attentive to insure accuracy. When relieved of this routine, the engineer has more jobs in progress at a given time. The girl working with him has more variety in calculations and tabulations.

Basic Theory Gained in One Year

The clerk interested in doing a good job wants to know the "why" of the operation. She frequently asks questions which the engineer finds difficult to explain in language she understands. Those presently in this work for over a year have considerable understanding of basic electrical theory.

Practice is to take time to answer all their questions. The girls develop a healthy curiosity, in a manner and to the extent that they can understand. This pays dividends in that they undertake more involved assignments with minimum assistance and explanation.

This training program has often tried the engineer's patience, but when viewed in the light of results later, they will not hesitate to carry the explanation equally as far on the next question. The engineer reaps immediate benefits as he is relieved of routine tasks and finds valuable assistance in many more important assignments.

Girls cannot be rushed in doing a job, and they should not be rushed through a training period. Like everyone, they enjoy praise for a job well done and such expressed recognition pays worthwhile dividends.

Three methods of work assignment for the engineering clerk have been considered: Pool operation, whereby an engineer requests one or more as his work load requires; and group assignment, whereby she is assigned to two or more planning engineers where she regularly carries out duties only under their supervision. Organization of Consumers Power Co's Distribution Studies Section best lends itself to the group assignment utilization.

Five Areas Have One Clerk Each

Consumers Power Co serves an area of 27,000 sq mi with 35,000 mi of primary distribution lines. For distribution planning this territory is divided into five areas with an area-planning engineer, a junior or assistant engineer, and a girl technical clerk for each area. Each group is responsible for all eventual and immediate area plans for their divisions.

Another group of two engineers and a female clerk coordinates all distribution sectionalizing devices, short-circuit calculations in connection with customer application of flicker-producing devices, and customer application of capacitors as required by the division or area-planning engineer.

A final group does special investigations of problems affecting general distribution system. Problems of this nature involve effects of new utilization equipment, water heater controls, and improvements in present methods. Technical clerks offer considerable assistance to this group in translating data from graphic charts, data tabulations, and the plotting of curves.

Setup Works Best in Large Groups

Use of girls is also proceeding in operating divisions for drafting, estimating, and other technical duties. Results have been spotty, ranging from poor to excellent. Success is more evident in larger groups where duties can be subdivided and broken down into more mechanized procedures.

In addition to this, the attitude of supervisors and other engineers in the divisions must be tolerant, helpful, and patient. They must accept necessary changes for this system to progress.

Tabular Forms Reduce Capacitor

- Florida Power & Light develops easy-to-use forms to simplify the application of secondary capacitors to 3-phase banks
- New procedures cut from a day to an hour the time needed to analyze effect of capacitors on reducing voltage drop

Tabulation of Transformer Loads—1 and 3-Phase Closed Wye-Delta Banks

Total 3 phase load 127 kw; P.F. .85 ; θ_T 31°47; Kva_T 150
Total 1 phase load 24 kw; P.F. .8 ; θ_1 36°52; Kva_1 30
Phase Sequence A B C ; Lighting Transf. on A Ø

by Definition
- KVAR = Lagging Reactive
+ KVAR = Leading Reactive

Type Load	Transformer Load and Characteristics			
	KVA = Kw/P.F.	α*	KW = KVA Cos α	KVAR = KVA Sin α
1. LIGHTING TRANSFORMER				
3Ø	50 (1/3 3Ø KVA)	31°47' (θ_T)	42.5 (KVA Cos θ_T)	- 26.35 (KVA Sin θ_T)
1Ø	20 (2/3 1Ø KVA)	36°52' (θ_1)	16.0 (KVA Cos θ_1)	- 12.00 (KVA Sin θ_1)
Subtotal	70	33°14'	58.5	- 38.35
Capacitor on Lighting Transf.	20 (2/3 Cap. KVAR)	90° (90°)	0 (KVA) (0)	+ 20 (KVA) (1)
Capacitor on Lagging Transf.	10 (1/3 Cap. KVAR)	150° (150°)	- 8.66 (KVA) (-.866)	+ 5.0 (KVA) (+.5)
Capacitor on Leading Transf.	— (1/3 Cap. KVAR)	— (30°)	— (KVA) (+.866)	— (KVA) (+.5)
Total	51.6	15°2'	49.84	- 13.35'
2. LAGGING TRANSFORMER				
3Ø	50 (1/3 KVA.)	31°47' (θ_T)	42.45 (KVA Cos θ_T)	- 26.3 (KVA Sin θ_T)
1Ø	10 (1/3 KVA$_s$)	96°52' (60 + θ_s)	- 1.07 (KVA Cos(60+θ_s))	- 9.94 (KVA Sin(60+θ_s))
Subtotal	55	41°21'	41.43	- 36.29
Capacitor on Lighting Transf.	10 (1/3 Cap. KVAR)	30° (30°)	8.66 (KVA) (+.866)	+ 5.0 (KVA) (+.5)
Capacitor on Lagging Transf.	20 (2/3 Cap. KVAR)	90° (90°)	0 (KVA) (0)	+ 20.0 (KVA) (1)
Capacitor on Leading Transf.	— (1/3 Cap. KVAR)	— (150°)	— (KVA) (-.866)	— (KVA) (+.5)
Total	51.3	12°41'	50.09	- 11.29
3. LEADING TRANSFORMER				
3Ø	50 (1/3 KVA$_T$)	31°47' (θ_T)	42.45 (KVA Cos θ_T)	- 26.35 (KVA Sin θ_T)
1Ø	10 (1/3 KVA$_s$)	23°08' (60°- θ_s)	9.2 (KVA Cos(60°-θ_s))	3.93 (KVA Sin(60°-θ_s))
Subtotal	57.2	23°28'	51.65	- 22.42
Capacitor on Lighting Transf.	10 (1/3 Cap. KVAR)	150° (150°)	- 8.66 (KVA) (-.866)	+ 5.0 (KVAR) (+.5)
Capacitor on Lagging Transf.	10 (1/3 Cap. KVAR)	30° (30°)	8.66 (KVA) (+.866)	+ 5.0 (KVA) (+.5)
Capacitor on Leading Transf.	— (2/3 Cap. KVAR)	— (90°)	— (KVA) (0)	— (KVAR) (1)
Total	53.1	13°33'	51.65	- 12.42

*α = Angle between Transformer Voltage and Current for individual load.

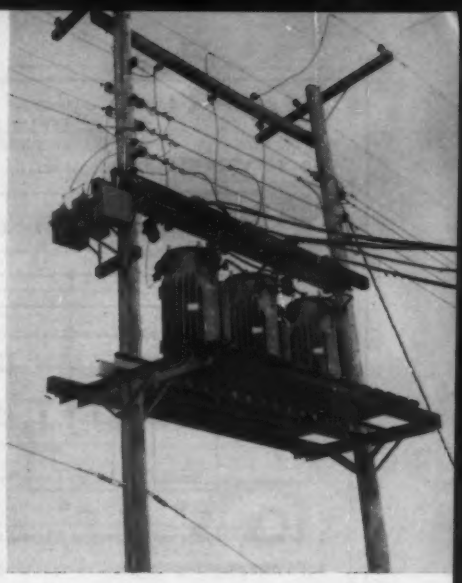
$$\% \text{ Voltage Drop} \approx \frac{(Kw)(\%R) - (KVAR)(\%X)}{\text{Transf. KVA.}}$$

FIG 1—EASY-TO-USE TABULAR FORM simplifies the application of secondary capacitors to 3-phase transformer banks. Florida P&L engineers use this form to avoid the time-consuming vector analysis of closed wye-delta banks

Engineering Time by 85%

E. L. BIVANS, Section Head, System Planning, General Engineering Department;

V. B. NOLAN, Miami Area Engineer, Florida Power & Light Co, Miami, Fla.



Tabular forms and procedures are saving Florida Power & Light Co 85% of the engineering man-hours required for analyzing the effects of capacitors on reducing voltage drop and unbalance. The forms simplify the application of secondary capacitors to 3-phase transformer banks.

A prerequisite of intelligent use of capacitors is a knowledge of the load division between transformers. This division for closed wye-delta banks differs from that for open wye-delta banks.

Load Splits Equally

In a three-transformer wye-delta bank with primary neutral ungrounded, two-thirds of the single-phase current is supplied by the lighting transformer. The other third is supplied by the other two transformers in series and is in phase with the current of the lighting transformer. Three-phase load, however, splits equally among the three units. These load divisions apply regardless of relative size or impedances.

However, vectorial combination of the single and 3-phase loads gives unequal power factors and loadings in the two power transformers (Fig 2). For lagging power-factor loads, the lagging transformer is generally loaded more heavily and has a poorer power factor than the leading transformer. (The lagging transformer is connected to the primary phase behind the phase of the lighting transformer; the leading transformer to the phase ahead of the lighting transformer.)

Vector Analysis Obviated

FP&L set up an easy-to-use tabular form to avoid time-consuming vectorial analysis of closed wye-delta banks. This simplified the job of the engineers who already have a booming load growth on their hands.

On this tabular form (Fig 1) lines are allocated for characteristics of single and 3-phase loading of each transformer. Combining these loads by use of trigonometric functions gives the total load on each transformer ("Subtotal" on the form). With power and reactive loads thus separated, it becomes apparent whether capacitors can be used to advantage.

Effect of capacitors on each transformer is determined by completing the form, using the lines for the three possible capacitor connections. Again, it must be remembered that two-thirds of the capacitive current is supplied by the transformer across

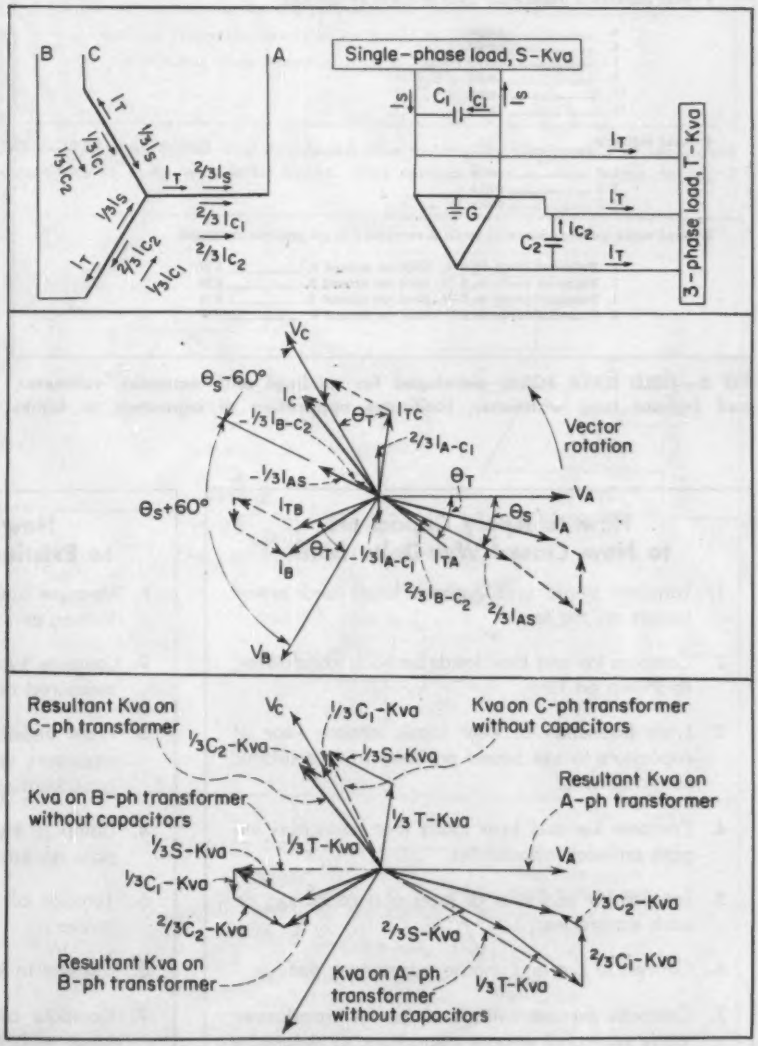


FIG 2—VECTORIAL COMBINATION of single and 3-phase loads on closed wye-delta banks gives unequal power factors, loadings in two power transformers

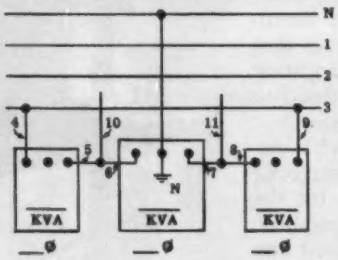
FIELD DATA
TRANSFORMER LOADING

LOCATION OF BANK _____ DATE _____

_____ TIME _____

BY _____

TRANSFORMER BANK FACING SECONDARY SIDE



NOTE:
FOR OPEN DELTA BANKS, DELETE MISSING TRANSFORMER FROM SKETCH TOGETHER WITH ITS CURRENT AND KW READINGS

1. Complete transformer connection diagram to the secondary bus.

2. Connect phase sequence leads to corresponding secondary numbered terminals in diagram.

   Phase sequence is _____

3. Read amperes in transformer leads or risers as indicated.

   4. _____ amps.
   6. _____ amps.
   7. _____ amps.
   9. _____ amps.
   10. _____ amps.
   11. _____ amps.

4. Read voltages

   1-2 _____ volts
   2-3 _____ volts
   1-3 _____ volts

5. Read watts (reverse potential leads if necessary to get positive readings).

   1. Potential leads on 4-5, hook-on around 4. _____ KW
   2. Potential leads on 6-N, hook-on around 6. _____ KW
   3. Potential leads on 7-N, hook-on around 7. _____ KW
   4. Potential leads on 8-9, hook-on around 9. _____ KW

FIG 3—FIELD DATA FORM, developed for readings with ammeter, voltmeter, and 1-phase tong wattmeter, facilitates application of capacitors to banks

which the capacitor is connected, and one-third by the other two transformers in series.

For usual power factor loads little benefit, if any, is gained by applying capacitors across the leading transformer. But this general rule does not apply where the load is practically all 3-phase.

The equation at the bottom of the tabular form is used to compute the percent voltage drop through a transformer. This equation, an approximation, is based on the assumption that the neutral shift is negligible. Actually the shift is very slight, provided the primary voltages are balanced.

Voltage drop obtained from the equation is minimized if inductive kvar, which carries a negative sign, is kept small. Likewise, capacitive kvar, carrying a positive sign, minimizes voltage drop and may cause a voltage rise.

The procedure for determining the amount and location of capacitors (see accompanying box) covers both new and existing closed wye-delta banks. To facilitate the application of capacitors to existing banks, a form (Fig 3) was developed for taking readings in the field with an ammeter, voltmeter, and single-phase tong wattmeter. If single and 3-phase-load power factors are known, only line currents have to be measured. Where possible,

How to Apply Capacitors to New Closed Wye-Delta Bank

1. Tabulate single and 3-phase loads and power factors on the form.
2. Compute kw and kvar loads on each transformer, as shown on form.
3. From inspection of kvar loads, choose kvar of capacitors to use based on company's economic considerations.
4. Compute kw and kvar loads that capacitors impose on each transformer.
5. Totalize kw and kvar of load plus capacitors on each transformer.
6. Convert to kva and choose transformer size.
7. Compute percent voltage drops for transformer loads with and without capacitors to determine their effect.

How to Apply Capacitors to Existing Closed Wye-Delta Bank

1. Measure phase rotation, kva and kw per transformer, and voltages, using field data form.
2. Compute kvar per transformer; tabulate this and measured data on form.
3. From inspection of kvar load, choose kvar of capacitors to use based on company's economic considerations.
4. Compute kw and kvar load that capacitors impose on each transformer.
5. Totalize all kw and kvar loads on each transformer.
6. Convert to kva to check transformer loading.
7. Compute percent voltage drops for transformer loads with and without capacitors to determine their effect. Check against measured voltage.

FP&L engineers prefer to measure the other quantities, although they can be determined by a graphical method.

On open wye-delta banks the determination of loading is somewhat simplified because the primary neutral is grounded, and there are only two transformers. However, it is still necessary to know whether the power transformer is leading or lagging the lighting transformer.

Ordinarily, the power transformer is the lagging one on the FP&L system. In this case the lighting transformer furnishes all single-phase load in an open wye-delta bank supplying single and 3-phase loads. Three-phase currents are equal in the two transformers, but the power factor is worse in the lighting transformer than in the lagging power transformer (Fig 5).

Because capacitors affect load only on the transformer across which they are connected, they are highly effective in decreasing currents in the lighting transformer. Adding capacitors across the power transformer is not very effective unless the 3-phase-load power factor is quite bad.

None Across Open Leg

Capacitors are not connected across the open leg of the delta. With this connection, along with a blown primary fuse on the power transformer, series resonance develops between the capacitor and the open-circuit inductance of the transformer. This condition has resulted in more than 600 v across the 240-v winding of the power transformer and has blown capacitor fuses.

A second tabular form (Fig 4), developed to simplify the application of secondary capacitors to open wye-delta banks, applies where the power transformer is on the lagging phase. It is used in the same manner as the form for closed transformer banks.

FP&L has made 30 installations of capacitors at the secondaries of transformer banks, excluding the underground network. About 90% of these were made using the tabular forms. In these cases the engineering time was reduced from about one day to 1 hr. Voltage drops calculated by this method compare well with those measured after capacitors were applied.

Tabulation of Transformer Loads — 1 and 3-Phase Open Wye-Delta Banks

Total 3φ Load _____ kw; P.F. _____; θ_s _____; Kva$_s$ _____
Total 1φ Load _____ kw; P.F. _____; θ_l _____; Kva$_l$ _____
Phase Sequence _____

By Definition
- Kvar = Lagging Reactive
+ Kvar = Leading Reactive

Type Load	Transformer Load and Characteristics			
	KVA	ϕ *	KW = KVA Cos ϕ	KVAR = KVA Sin ϕ
LIGHTING TRANSFORMER (on Leading θ):				
1φ	(KVA$_l$)	θ_l	(KVA Cos θ_l)	(-KVA Sin θ_l)
3φ	(.577 KVA$_T$)	(θ_T + 30)	KVA Cos (θ + 30)	(-KVA Sin (θ_T + 30°)
Subtotal				
Cap. KVAR on Lighting Transf.	(Cap. KVA)	(90)	(KVA Cos 90°)	(+KVA Sin 90°)
TOTAL				
LAGGING TRANSFORMER				
3φ	(.577 KVA$_T$)	(θ_T - 30°)	KVA Cos (θ_T -30°)	(-KVA Sin (θ_T - 30°)
Cap. KVAR on Lagging Transf.	(Cap. KVA)	(90°)	(KVA Cos 90°)	(-KVA Sin 90°)
TOTAL				

*ϕ = Angle between Transformer Voltage & Current for individual load.

Voltage Drop Through Transformer = $\frac{(Kw)\,\%R - (KVAR)\,\%X}{Transf.\ KVA.}$

FIG 4—TABULAR FORM was developed also to simplify application of secondary capacitors to open wye-delta banks. This second form is used same as Fig 1

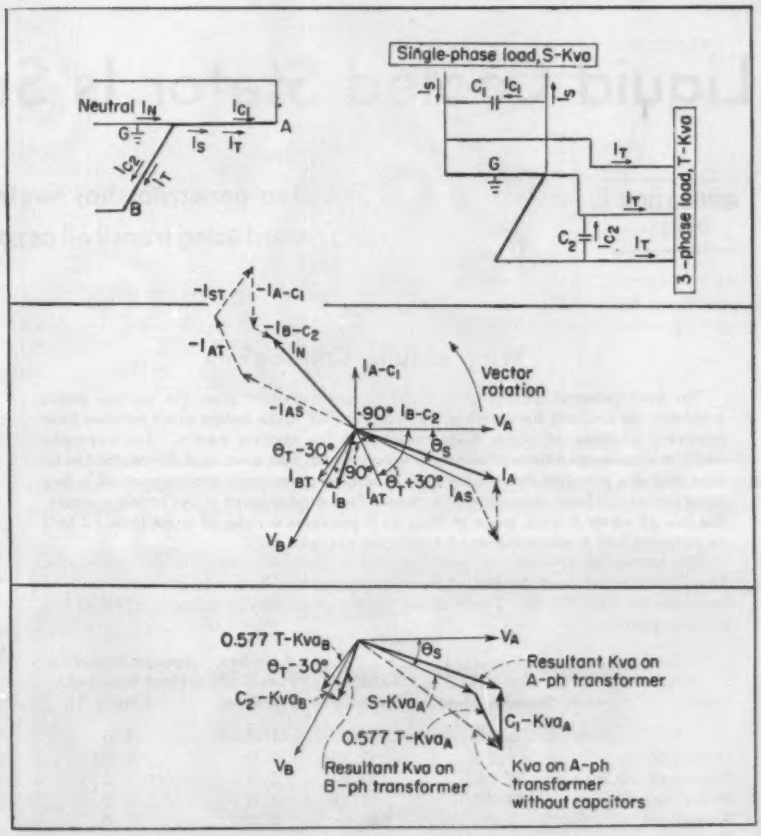
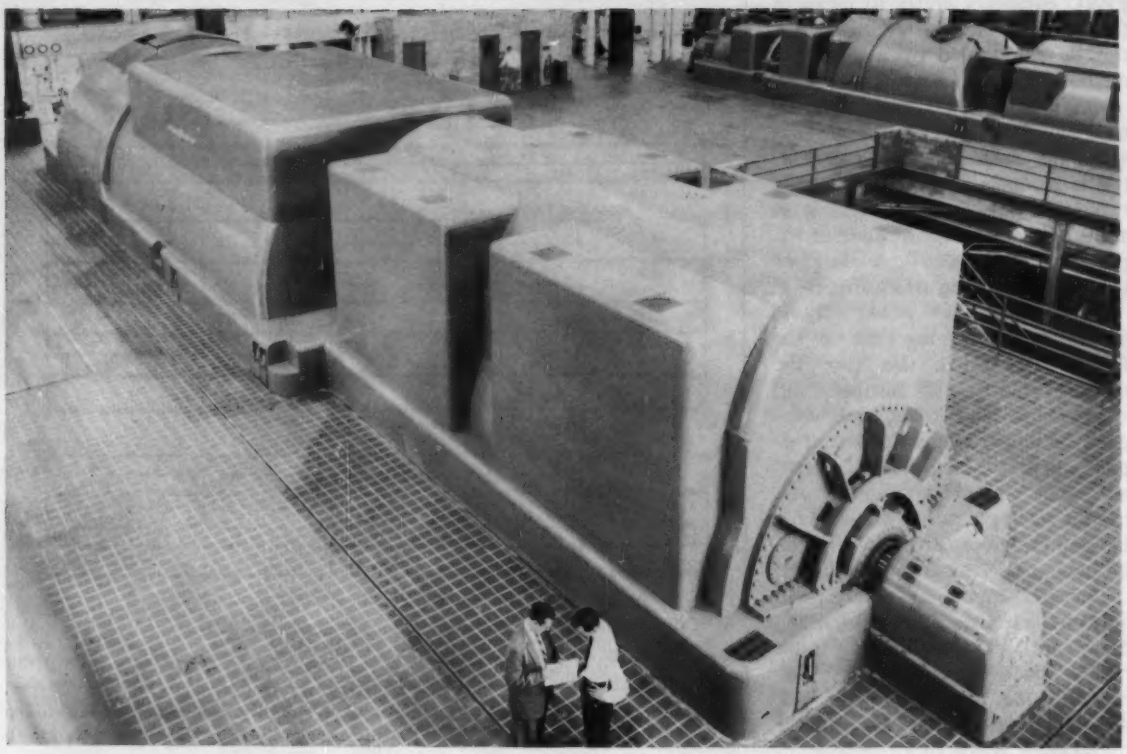


FIG 5—VECTOR DIAGRAMS for open wye-delta transformer bank with single-phase load on leading unit were superseded by time-saving tabular forms



Liquid Cooled Stator Is Success

GENERATION
Design

291-Mva generator has twelve months satisfactory operating record using transil oil as coolant in hollow stator windings

C. H. HOLLEY, Large Steam Turbine-Generator Dept, General Electric Co, Schenectady, New York

Employing liquid as a coolant for conductor-cooled stator windings seems to be the most promising approach to the design and manufacture of large steam turbine-generators. The most recently installed unit of the Eastlake Station of the Cleveland Illuminating Co is excellent proof of the soundness of this approach.

The generator in question is rated 290,910 kva, 18,000 volts. It has liquid coolant flowing through hollow conductors in the stator windings to remove by direct contact the heat generated by the losses in these conductors.

This machine has been in satisfactory operation since March 1956.

Why Liquid Cooling?

The heat removal ability of a liquid is much greater than the various gases available as coolants for rotating machinery. The table below gives relative heat removing abilities of some fluids considered for cooling media. For example, under the same conditions of temperature rise and duct area and with velocities of flow that are practical for employment in turbine-generators, transformer oil is five times superior in heat removal ability than is four atmospheres of hydrogen pressure. The use of water is even more striking as it provides a ratio of more than 12 to 1 as compared to 4 atmospheres of hydrogen pressure.

This beneficial situation is quite helpful in designing very large generators. The liquid-cooled Eastlake No. 4 machine is actually only one ft longer and 61 tons heavier than the No. 3 unit at the station even though it has a 134,910 kva larger capacity.

Fluid	Relative Specific Heat	Relative Density	Relative Practical Vol Flow	Approx Relative Heat Removal Ability
Air	1.0	1.0	1.0	1.0
Helium, ½ lb	5.25	0.138	1.0	0.75
Hydrogen, 30 lb	14.35	0.21	1.0	3.0
Hydrogen, 45 lb	14.35	0.28	1.0	4.0
Transil oil	**2.09**	**848.0**	**0.012**	**21.0**
Pyranol	1.09	1,510.0	0.012	20.0
Water	4.16	1,000.0	0.012	50.0

An inspection of the stator windings in Oct. 1956 after seven months' operation showed no evidence of leakage or any other unsatisfactory condition.

The Eastlake generator has a number of unique features. For one thing a large top dome structure was utilized to facilitate shipment. This large dome houses four hydrogen coolers. They are mounted horizontally and transverse to the machine axis. The cooler water boxes and the necessary water piping are concealed beneath the four vertical lagging enclosures. This arrangement permitted the generator to be built with a one-piece stator frame.

Windings Factory Assembled

Stator core and windings were completely factory assembled, tested, and shipped as a single unit. Normal operation of this generator is at a casing pressure of 30 psi hydrogen.

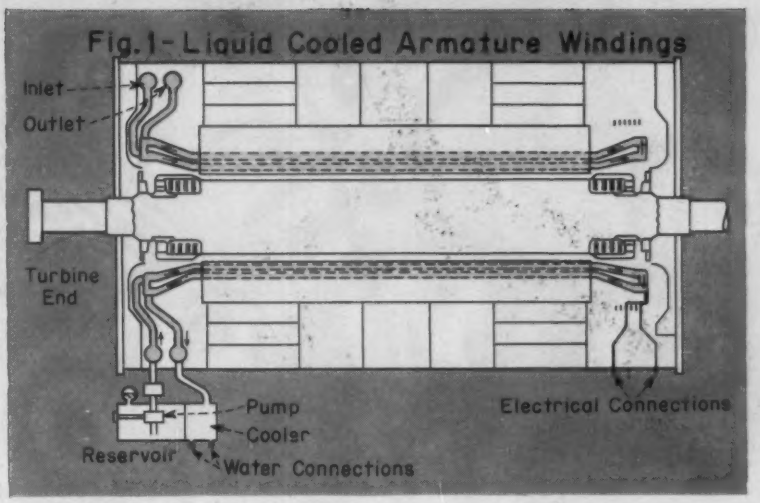
Hydrogen at a normal casing pressure of 30 psi is used to cool the gap-pickup type rotor winding, and the conductor-cooled lower stator leads, and high-voltage bushings.

Cooling the stator windings and stator connection rings with liquid requires only low pumping pressures. This eliminates high-pressure, high-loss devices such as blowers or compressors. The hydrogen can therefore be circulated by means of conventional low-pressure single-stage axial flow fans, one mounted at each end of the rotor shaft.

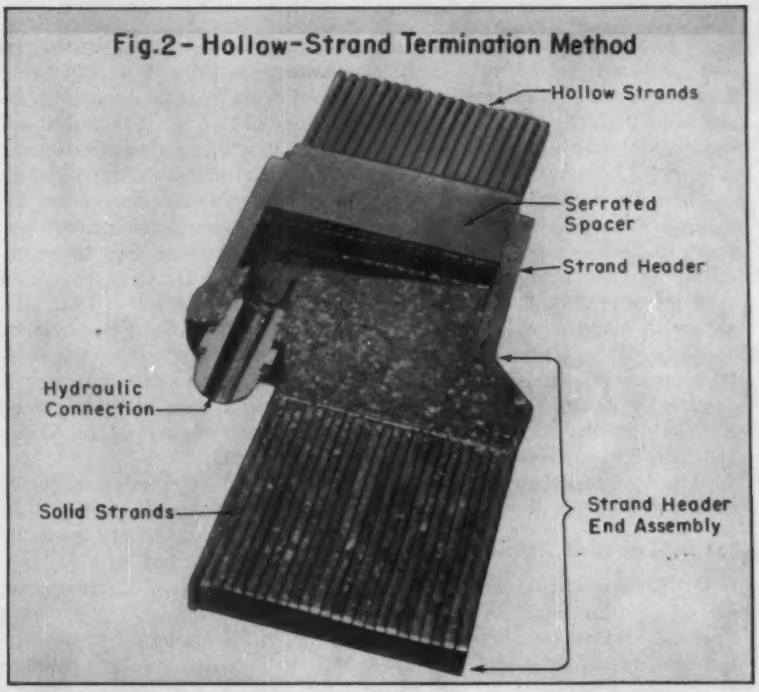
Pumping Needs Small

External pumps circulate the liquid through the stator windings. Regulating valves and coolers complete the major portions of the cooling system. The coolers are of the water-tube type with a double-walled tube construction. The annular space between the inner and outer tube provides a drain off in the event of tube leakage. This prevents the cooling water from leaking into the stator winding coolant.

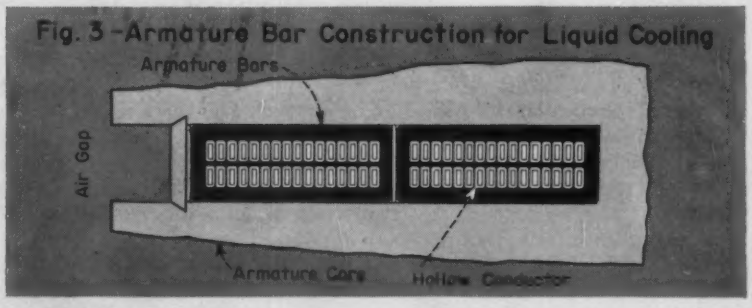
The cool liquid is distributed around the periphery of the winding inside the stator frame by means of a circular header and enters the stator winding through insulating and flexible connections at the turbine end of the generator. The flow is a two-pass arrangement with



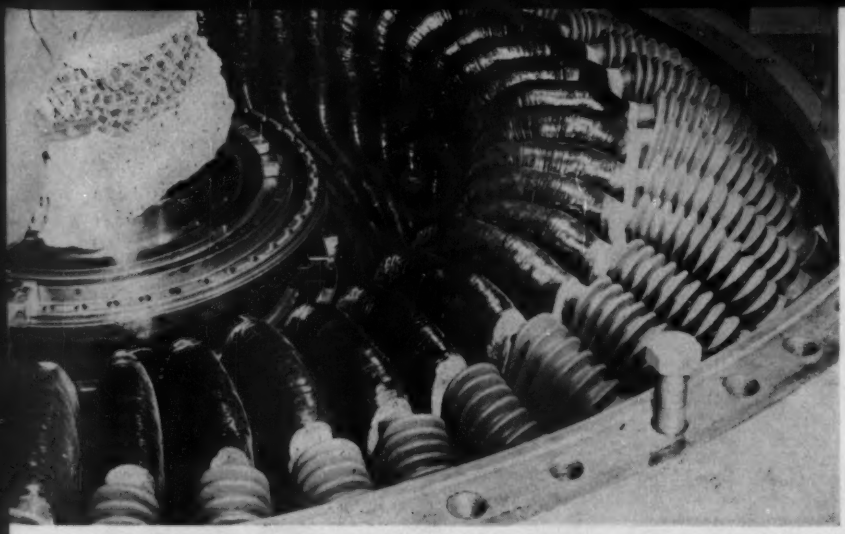
LIQUID COOLANT allows smaller frame sizes. The 291-Mva Eastlake unit has a bearing span only one foot longer than a 156-Mva unit in the same station



HYDRAULIC CONNECTIONS are made at the end assembly. The hollow strands are joined at the ends of the bar by a high-temperature brazing operation



LIQUID FLOW IS a two-pass arrangement. Coolant flows in bar nearest the air gap from turbine end of unit to collector end and returns in the bottom bar



LIQUID CONNECTIONS are made at turbine end of unit through flexible metal hoses encased in rubber boot. This is view of unit after seven months operations

the liquid flowing through the hollow conductors in the top bar (bar adjacent to the air gap), and returning from the collector end through the bottom bar of the same coil (Fig 1).

The hollow strands are joined at the ends of the bar by a high-temperature brazing operation. Fig 2 shows a cross-section of the termination of the strands into a strand header. Hollow strands are shown at the top of the figure. The method of bringing off the electrical connection by means of solid strands is shown in the foreground. The hydraulic connection is shown in the left foreground adjacent to the electrical connection.

Bar Replacement Simple

This arrangement permits the use of conventional soft-soldered electrical connections between top and bottom coil sides and provides permanent attachment of the hollow conductors to the strand header. During initial assembly, therefore, and when maintenance work requires replacement of armature coils the bars are handled the same as a conventional winding with the single exception of making the hydraulic connection needed for the liquid coolant.

After factory test, experience in replacing stator bars containing special instrumentation proved that the removal of oil for bar replacement was a simpler job than originally anticipated. As a result, it is not necessary to remove the oil from the complete winding in order to do maintenance work, but only to let the oil drain from the armature bars in question. Each bar holds approximately one gallon of oil and it is a simple matter to catch the oil draining from the ends after the hydraulic connections are opened. A little air pressure may be necessary to remove oil from bars with ends pointing upwards.

Oil is replaced in the system by introducing it into the reservoir tank and then recirculating it through the system. Any entrapped air is carried out by the oil to the tank and detrained.

No additional time was required for installation and start-up. In fact, the generator was phased-in for commercial operation just 51 days after the stator was shipped from the factory.

The application of conductor cooling and the resulting rate-up of the generator frame size necessitates high excitation requirements.

Operation of the external liquid system is completely automatic. It is somewhat similar in this respect to the highly successful hydrogen seal oil systems. In this machine, transformer oil was used as a liquid coolant for the stator windings after a large number of various types of liquids were thoroughly considered. Oil is circulated through the liquid system and is automatically maintained at a pressure of about 3 psig below the hydrogen casing pressure by means of a vacuum system. This vacuum treatment removes the primary elements of oil deterioration such as oxygen and moisture.

The liquid system is arranged with alarms for such things as low flow, improper temperature, and loss of liquid to the winding. In case of the latter, load is reduced 50% because of the fast thermal response inherent in conductor-cooled windings.

Extensive factory and field tests revealed the conservative thermal design in this prototype generator. For example, at 260,000 kva, 30 psi hydrogen pressure the oil temperature rise through the armature winding was 38C and the copper temperature was about 4C above this. The high-voltage bushings showed an 11C rise over the incoming cold gas when carrying rated current of 8,340 amp. Generator field winding had an average rise of 38C above cold gas temperature.

Oil Retains Properties

The stator hot spot copper temperature has shifted from the center of the machine as on a conventional winding to the outlet end of the bottom bar in the liquid circuit. As indicated by the figures above, the measurement of the outlet oil temperature gives a close indication within a few degrees of the actual copper temperature. Standard stator RTD's become less significant during the operation with liquid flowing through the winding as is indicated by the fact that the RTD's in the center of the machine varied only 16.5 degrees over a load range from 130,000 kva to 260,000 kva.

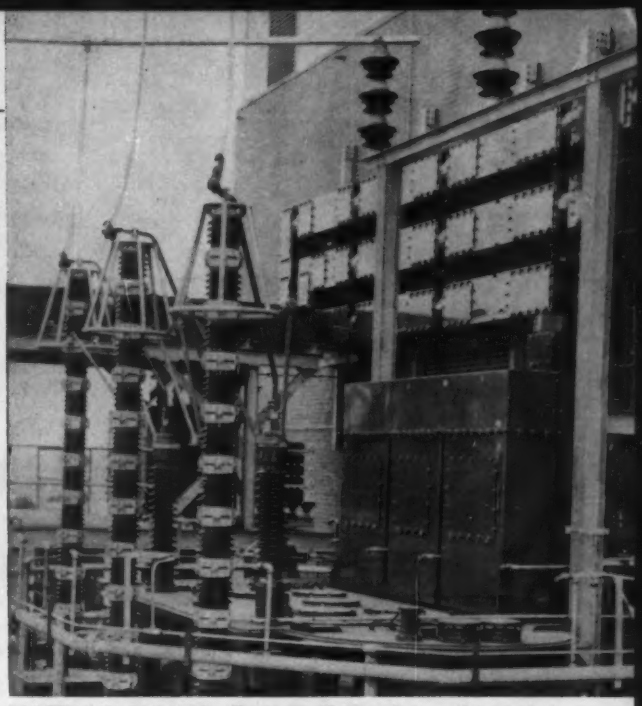
Since the start-up of this generator, periodic samples taken from the liquid system show that the dielectric strength of the oil has remained, within test tolerances, at its initial level. Dielectric strength is, of course, an important requirement as the liquid must flow through insulating connections from the headers at ground potential to the high-voltage windings.

The ability of the oil to withstand sludge precipitation is also very important. Tests on neutralization number, interfacial tension, and other characteristics has shown little change from new oil. Thus, there is a wide margin from any critical values which would indi-

(Continued on page 142)

Forced-Air-Cooled Bus Good for 10,000 Amp

Preliminary field tests on an actual isolated phase bus installation have proven satisfactory. Close circuit cooling is employed



FORCED-AIR COOLING allows smaller enclosure (30 sq. in.) and thereby offers economic and space-saving advantages

N. SWERDLOW, Senior Engineer,
High Voltage Switchgear Dept,
General Electric Co, Philadelphia, Pa.

Isolated phase bus will not be the limiting design factor as generating unit sizes increase due to the development of forced air cooled isolated phase bus. Preliminary field tests on a 10,000-amp bus of this type indicate that it will easily meet its rating with ample margin.

The forced air cooled bus was developed to overcome difficulties in handling high current ratings with conventional bus cooled by natural convection and radiation (see box).

It is true that a larger conductor and enclosure will have larger cooling surfaces so that heat dissipation is improved by an increase in the physical size. However, this improvement will not usually offset the considerations listed above if heat is dissipated by natural convection and radiation only.

Because of this and the desire to develop an economic design, methods of heat dissipation other than that afforded by natural convection and radiation were investigated. The limitations of manufacturing facilities of the bus manufacturer and his suppliers also stimulated this investigation. Forced air cooling, forced gas cooling, and forced oil cooling were all studied.

Forced air cooling system was selected because of its simplicity and the relatively low cost components. By moving the air in the bus enclosure, a material improvement in heat dissipation is experienced. The improvement is due to two factors:

1. Direct removal of heat. The moving air picks up heat from the conductor and enclosure and carries it away so that it can no longer raise the temperature of the bus components.

2. "Scrubbing" action. The movement of the air tends to breakdown the layer of hot air immediately adjacent to the metallic parts of the conductor and enclosure which contributes so greatly to the temperature rise of these parts over the adjacent air.

During the design stages of a typical isolated phase bus rated 8,000 amp, it became apparent that future requirements for buses would be greater than this latter rating. In fact, exploratory talks with generator designers indicated that bus designs should be available for ratings up to 10,000 amp. Prompted by this requirement, and for the reasons given in the introduction, it was decided to make forced air cooling tests on the 8,000

What makes high current capacity bus design costly?

As generator loads increase, the cost of providing buses increases in more than direct ratio for several reasons:

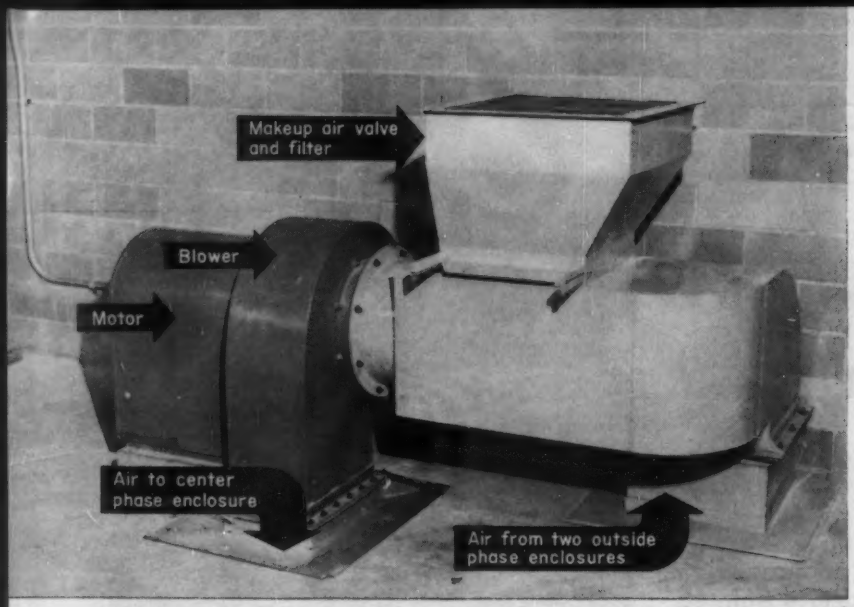
1 Conductor losses are proportional to the current squared. Thus, lower current densities must be provided in the conductor material so that ac resistance can be reduced to compensate for this increased current.

2 Other factors such as skin effect, and sheath losses, increase rapidly as the conductor size increases.

3 Enclosure fabrication cost increases because of large physical size and increased thickness of enclosure material.

4 Conductor cost increases because of manufacturing limitations of material suppliers.

5 Space requirements increase for self-cooled bus.



FAN RECEIVES air from two outer phase enclosures and forces it through center phase enclosure. Make-up air is filtered and admitted on suction side of fan

amp isolated phase bus when it became available for heat runs.

Heat runs at 8,000 amp self cooled and 10,000 amp forced air cooled were made. The 10,000-amp tests showed that relatively little air was required to reduce the hot spot temperature rise of the 8,000-amp conductor to 50C.

From this heat run, sufficient data were obtained to check design equations. Included in this heat run setup was the means for studying induction heating effects of the bus on structural steel members.

Coincident with the bus design study, the Generator Engineering Division of the company with which the author is associated, was intertested in coordinating the design of generator terminations with that of isolated 10,000-amp phase bus.

A full size generator terminal box was built to which was attached a portion of 8,000-amp isolated phase bus. Included also was a full size self cooled neutral compartment with connections. The generator terminal box included the exact generator bushings and connections which would be applied to an actual job. The isolated phase bus was cooled by shop air supplied from an expansion tank, while the terminal box was cooled by a separate blower capable of furnishing 3000 CFM of air at 20 in. H_2O pressure.

The basic 10,000-amp force cooled isolated phase bus is shown below. So that maintenance will be kept to a minimum, a closed recirculating air system is used with temporary air filters used only during starting up periods if the bus has previously been opened.

More Cooling Air Needed

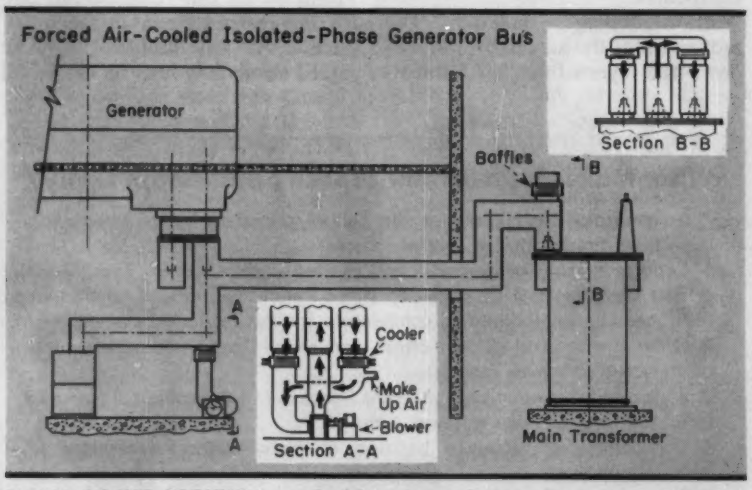
In an isolated phase bus the major portion of the enclosure eddy current losses appear in the center phase enclosure while the conductor losses are essentially the same for each phase. Hence more cooling air is required in the center phase than for either of the outer phases. For this reason, the cooling air is admitted to the center phase enclosure at the generator. Air flow is toward the transformer as shown below. At the transformer, the air divides, one-half returning to the fan over each outer enclosures.

Just after the air leaves the outside phase enclosures, it is cooled to 40C by air-water heat exchangers. After cooling, the two air paths are joined and cool air returns to the fan for recirculation. To take care of slight leaks a make-up air valve is included on the intake side of the fan where a filter is provided to clean the make-up air.

Baffle Halts Migration

A baffle is provided at the transformer end to prevent the migration of ionized air from one phase to the other in the event of a fault.

Cooling air is furnished by a centrifugal fan powered by a totally enclosed motor. Starting of the fan motor is automatically initiated by one of six thermostats mounted on the bus enclosures. Three thermostats are on the enclosure near the generator and the other three, are mounted on the enclosures near the transformer. Thus, the fan will not start unless at least one spot on the enclosure has a total temperature which exceeds a predetermined value. It is readily seen that the lower the ambient, the greater the current the bus will carry before the cooling air is supplied and therefore total temperature is the criterion rather than the temperature rise.



CLOSED CIRCUIT COOLING is used with air-water heat exchangers providing the means for heat dissipation. The system cools the isolated phase bus to 40C

At Cleveland Electric Illuminating Co's Eastlake Plant . . .

Control Boards All Face Operator

C. F. PAULUS, General Supervising Engineer, Plant Engineering Section, Plant & Substation Engineering Department, Cleveland Electric Illuminating Co, Cleveland, Ohio

A single room at Cleveland Electric Illuminating Co's Eastlake Station houses all electrical control and relay boards for the generator and transmission yard, as well as supply circuits to the auxiliary boards. The control boards are arranged in a segmented circular fashion with all panels facing the operator.

The electrical control room was not designed as a show place, yet more than 6,200 visitors last year admired its functional design. The operator, seated at his desk, can look through glass doors into the turbine room and along a shelf beside the turbine room to the transformers and generator circuit breakers. In an opposite direction he can look across the forebay to the transmission substation.

All controls, instruments, and relays are visible to the operator at his working position. Controls are on the front board; instruments and relays on either board. This easy-to-read arrangement was made possible by keeping the front board low and sloping the top of its back. The upper part of the rear of the benchboard is protected by a hinged cover normally closed to prevent personnel from coming in contact with the various instrument terminals.

A full-scale mock-up was employed to check the designed slopes of the control and instrument panels of the benchboard. This test produced the least bothersome light reflection and the best visual angle, thus enabling the operator to take the most accurate readings.

Hinging Draws Attention

Hinging of the horizontal portion of the benchboard along its front edge has attracted much attention. This arrangement offers two major advantages: (1) with the board open, lighting and accessibility are excellent, and (2) with the board lifted up, an electrical tester can readily check any part on the back for loose connections. Operating personnel confirmed the efficiency of this arrangement.

The control boards were installed with resilient mountings directly on asphalt tile. The tile had been laid over the concrete floor and cable holes. Multi-conductor control cables were fed from racks through openings drilled in the asphalt and brought up on the sides or front of the board to a height convenient for connecting.

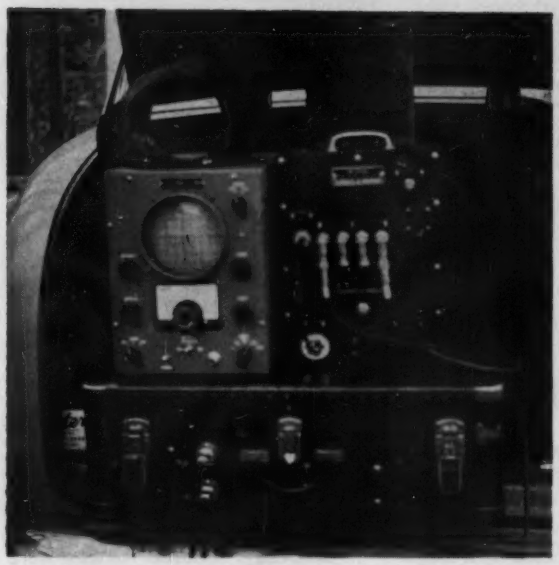
Generally, terminal blocks were not used, except on the front of the benchboard. This practice reduces the probability of poor connections in control circuits and makes it possible to derive greater value from coded conductors as they can be connected directly to the controls.

The boards were wired in the field with the thought that, when their backs became too crowded, some static devices would be moved to another room. Fortunately this proved unnecessary. Although the boards are quite full, they combine accessibility and adequate space between devices.

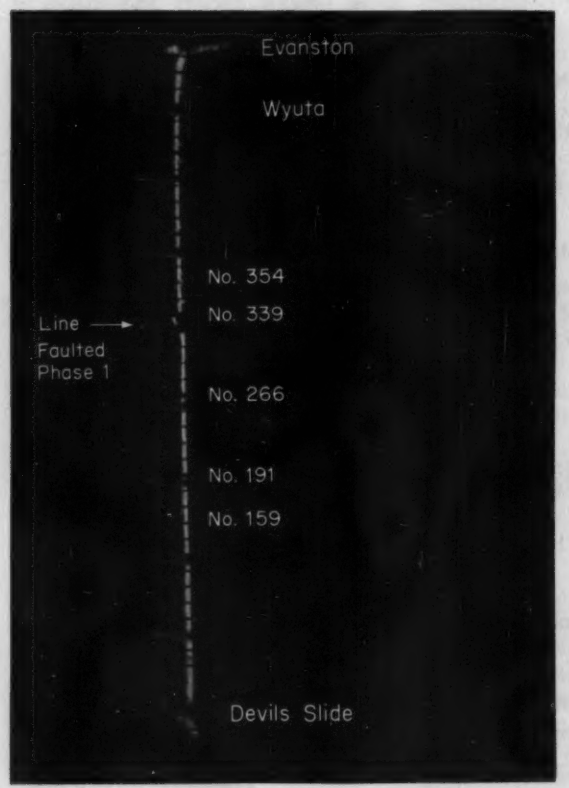
The room is air-conditioned, partially sound-treated, and at bench height has 100 ft-c lighting level, furnished by fluorescent tubes mounted above a luminous ceiling. In the corners behind the boards are air-conditioning equipment, dc control boards, oscillographs, station integrating meters, and washroom facilities.

Another room immediately below contains supervisory and microwave equipment, amplifier panels of a public address system, oscillograph batteries, ballasts for lighting the control room, an office for the electrical foreman, and considerable space for expansion. The two rooms were obtained by off-setting the buses leaving the generators.

Builds Accuracy into Fault Locator



RANGE CALIBRATOR (right) feeds vertical marker pips into radar-type locator for greater accuracy in finding faults



4-MILE INTERVALS between marker pips are independent of the linearity with time of the trace on the oscilloscope

R. A. RADFORD, Assistant Chief Engineer, Utah Power & Light Co, Salt Lake City, Utah.

Addition of a surplus range calibrator has built accurate range calibration into a standard radar-type fault locator. The calibrator used by Utah Power & Light Co introduces vertical pips at regular intervals on the oscilloscope trace. The locator-calibrator combination can be installed permanently and is sufficiently portable for checking several lines. Used in the latter manner, a portable rotary converter is employed as the power supply.

Flexibility of application is a desirable feature of trouble-shooting equipment used on the Utah P&L transmission system.

Distance Readings Varied

Utah P&L's fault-finding equipment had failed to give consistently accurate data, two or more readings on the same fault location not providing the same distance reading when the traveling marker pip was used.

This inaccuracy, it was suggested, could be overcome by proportioning the fault distance on the trace to the total known length of line. But this procedure was not satisfactory, as the trace is not necessarily always linear with time.

Accurate Reference Obtained

But two pieces of equipment purchaseable as military surplus items gave the desired accuracy. These were a Type CWI-60AAG radar-range calibrator driven by a Type CWI-20163 power supply. The calibrator introduces vertical pips on the oscilloscope trace at 1, 4, or 10-mile intervals, and the intervals are independent of the linearity with time of the trace. Thus there is always an accurate reference from which the distance to the fault may be determined.

Connecting the range calibrator and power supply to a standard fault locator required modification of only a few connections. The negative marker output from the calibrator is connected to one of the vertical deflection plates on the locator through a 400-v, 0.01-μf capacitor.

The negative-going square wave of the sweep unblanking multivibrator from the locator is used to pulse the input of the calibrator.

Power Supply Rebuilt

A 0.0015-μf capacitor had to be added across the tank circuit of the tank coil—the 4-mile timing marker circuit—to allow adjustment of frequency for proper 4-mile markers. The three-range marker tuned circuits had to be recalibrated for land instead of nautical miles.

The 400-cps power supply had to be rebuilt for 60-cps operation. Such rebuilding involved:

1. A new power transformer.
2. Two new 20-μf capacitors.
3. A 10-henry, 75-ma choke.

Unmasking a safe ground

Capacitors should be grounded to make them safe. Ask any lineman who has brushed against ungrounded equipment 25 feet up a pole—he'll tell you!

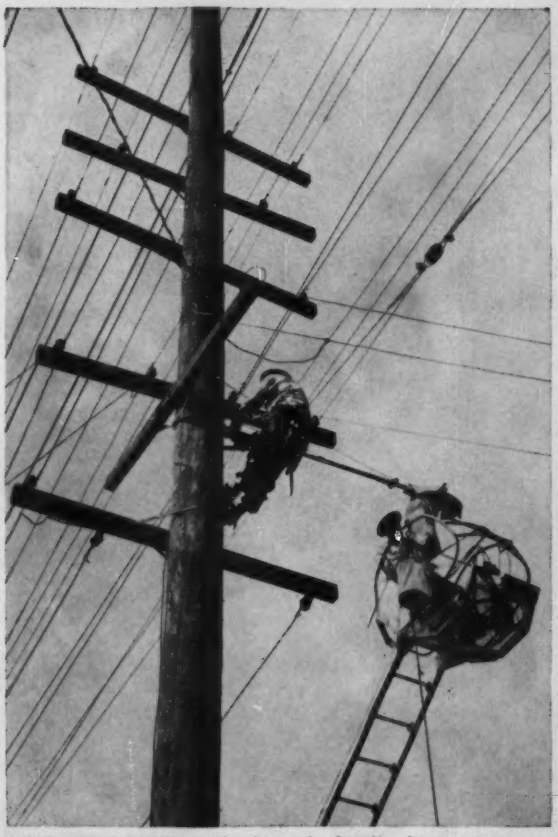
General Electric solves the problem of positively grounding 50-kvar capacitors by a simple step in finishing. The mounting hole area is masked during painting and the mask stripped off afterwards to leave clean, unpainted metal on the bottom of the bracket. The capacitor practically grounds itself as soon as it is mounted in a rack.

The ground is permanent, too. Corrosion won't foul the metal-to-metal contact.

Want to know more? Your G-E Apparatus Sales Engineer will welcome your capacitor questions. Or write to General Electric, Section 445-3, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC



INSULATED LADDER with electro-hydraulic drive raises new unit to position; one crew member levels, other bolts it

STREET-LIGHT CREW handle 15 to 18 operations per working day. Crew removes old units, mounts new masts, lights

DISTRIBUTION—Construction

Speed Installation of Street Lights

Installation of wired mast arms and luminaires on distribution pole lines by Portland General Electric Co is aided materially through the use of a truck-mounted, insulated electro-hydraulic ladder. With the ladder truck and a special mast arm trailer (EW, Jan. 14, p 67), a three-man crew can perform 15 to 18 operations per working day. By one operation is meant the taking down of an old arm and street light or the mounting of a new arm and luminaire.

To meet commitments with the City of Portland, PGE crews are installing several hundred 20,000-lumen mercury-vapor street lights. In the process, they are removing the older fixtures. The new lights are being installed on poles which may be raked either toward or away from the street. Thus, to have the luminaires located the same distance from the curb, it is necessary to use mast arms of various lengths.

Ladders Save Time

The truck-mounted ladders save time and prove helpful in determining the length of mast arm for each pole. For each straight run of poles, a transit is located out from the curb the same distance as the design distance of the luminaire. It is sighted along the pole line. The truck-mounted ladder raises one man with a level rod to the design height at each pole. The man on the ladder and the transit man, working together, determine the correct length of mast arm for each pole. For proper alignment of lights along the street, mast lengths ranging from 6 to 20 ft are required.

A special trailer designed by PGE carries 20 mast arms and has room for the needed glassware and other equipment.

(More How To on page 94)

FUSE LINKS

Service continuity . . .

Hangs by a thread

Specify dependable General Electric fuse links for accurate system co-ordination

In every power distribution system, service continuity hangs on a slender thread of wire . . . a fuse link. That's why this low-cost item is one of the most highly engineered products manufactured by General Electric.

More accurate system co-ordination is possible because of the greater uniformity of G-E fuse links. Extensive design tests, careful tests of incoming material, close supervision in manufacturing, and periodic quality control checks assure you of reliable, uniform performance on the line.

Maximum dependability results from a fusible element with a low melting point. This protects the fuse holders from charring during overloads.

Full-range operation from high to low currents *allows* all faults to be cleared quickly and positively. An auxiliary fuse tube of the proper length assures successful operation in the critical low-current range. Generally, *the majority of cutout failures are caused by faulty, low-current operation.*

General Electric fuse links are available in ratings for every system need, including EEI-NEMA Standard "K" and "T," Universal "N" rated and High Surge.

For further information, contact your nearest G-E Apparatus Sales Office, or write for bulletins:

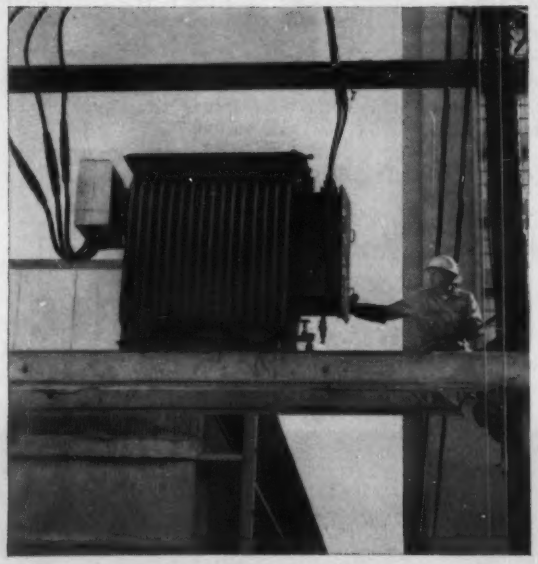
EEI-NEMA links GEA-6264
Universal "N" links GEA-1994
Hi-Surge links GEC-862
General Electric Co., Schenectady 5, New York

LIVE BETTER ELECTRICALLY

432-25

Progress Is Our Most Important Product

GENERAL ELECTRIC



SPANNING ALLEY, this G-E platform-mounted network transformer is close to load, yet out of the way. When necessary, servicing the unit is quick and easy.

Network system

Texas Power & Light Company uses platform mounting for transformers to meet rapidly expanding loads

Rapidly expanding commercial loads will soon outgrow Texas Power and Light's radial system in downtown Tyler, Texas. The utility, therefore, is installing a number of General Electric network transformers on the present system to help carry the load. Quickly and easily serviced, the transformers and the platforms are installed convenient to the load—behind buildings, over alleys, in back yards.

LOW INSTALLATION COSTS result from mounting G-E network transformers on platforms. This unit serves high-density load in the downtown area of Tyler, Texas.

for tomorrow goes up in the air today

EASY TO CONVERT TO NETWORK SYSTEM. Texas Power and Light plans to convert its radial system eventually to an overhead secondary network system. Conversion cost will be low since the network transformers are already installed and cabling will be the same. Only network protectors must be added to the system, now protected by fused aerial cable.

HELP FOR YOU. Plan *now* to meet tomorrow's load growth problems. Remember, it costs less in the long run to increase capacity by changing to a network than by expanding a radial system—and the sooner you start, the less it will cost you. Your nearest G-E Apparatus Sales Office will be glad to help you draw up a future network system. Or write for Bulletin GEA-2432, General Electric Co. Section 431-61, Schenectady 5, New York.

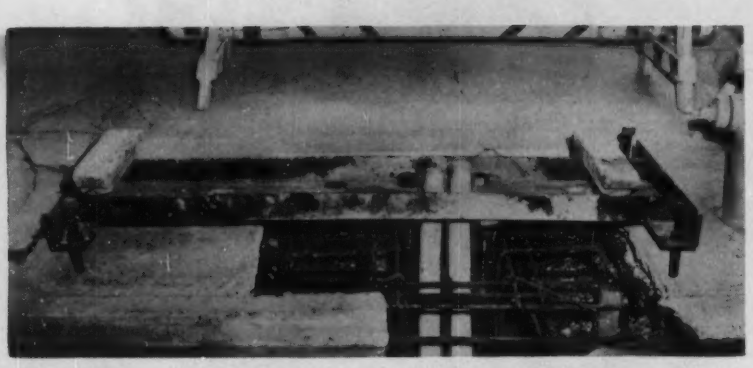
LIVE BETTER ELECTRICALLY

Progress Is Our Most Important Product

GENERAL ELECTRIC

Template Aids Street Light Anchoring

AL PEHRSON, Mechanical and Construction Superintendent, Indianapolis Power & Light Co, Indianapolis, Ind.



TEMPLATE HOLDS anchor bolts and transite duct ells are held in place while concrete bases for new fluorescent street light standards are being poured

A template devised in the mechanical and construction department of Indianapolis Power & Light Co aids in the installation of heavy street light columns.

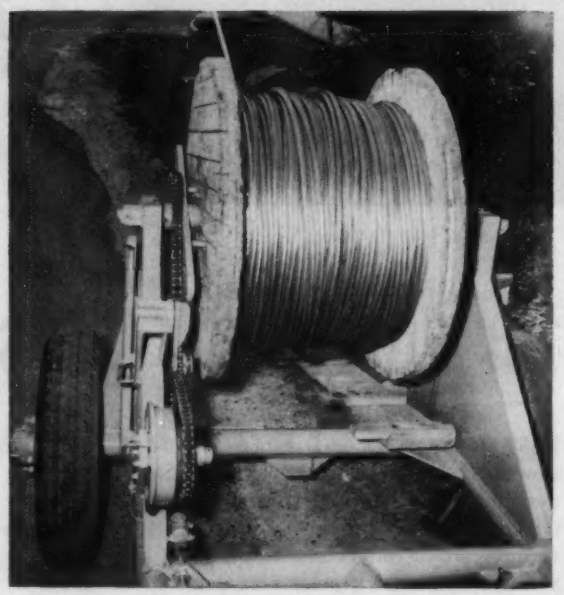
First use of the templates was in the recent installation of the "world's brightest" street lights in downtown Indianapolis. The davit-type steel columns for these lights weigh 915 lb and rise 33 ft above ground. The 12-tube fluorescent luminaires weigh 240 lb, making the total weight to be supported 1,155 lb. This required strong and precise anchoring.

The templates, were made to hold in position four 1½ in. dia 60-in. long anchor bolts and two 2½ in. transite duct ells during construction of the concrete bases in the sidewalk. The templates were made of 15 in. wide by 72 in. long channel iron with 4 by 4 in. angle iron end pieces with 1 in. adjustable bolts in each corner. They were center and offset drilled to meet conditions such as fire hydrant and other obstructions.

Due to the unevenness of each surface at each column, four corner adjustments were necessary. To add weight to hold the templates in position, pig lead was used at each end.

Hydraulic Brake Gives Better Tension Control

G. B. OGLESBEE, General Line Foreman, Beaumont Div, Gulf States Utilities Co, Beaumont, Texas



A hydraulic brake added to a wire-reel buggy by Gulf States Utilities Co permits accurate control of tension, facilitating stringing over hot lines, and saves muscle power. Its use makes working conditions safer.

The brake drum and master cylinder, salvaged from a low-price car, are mounted near the front and on one side of the trailer. The driving rod of the cylinder was threaded and screwed through a bolt and welded to the frame. A socket on the end of the driving rod permits a groundman to rotate the rod with a hot stick. This action accurately controls the hydraulic pressure which, in turn, controls tension of stringing.

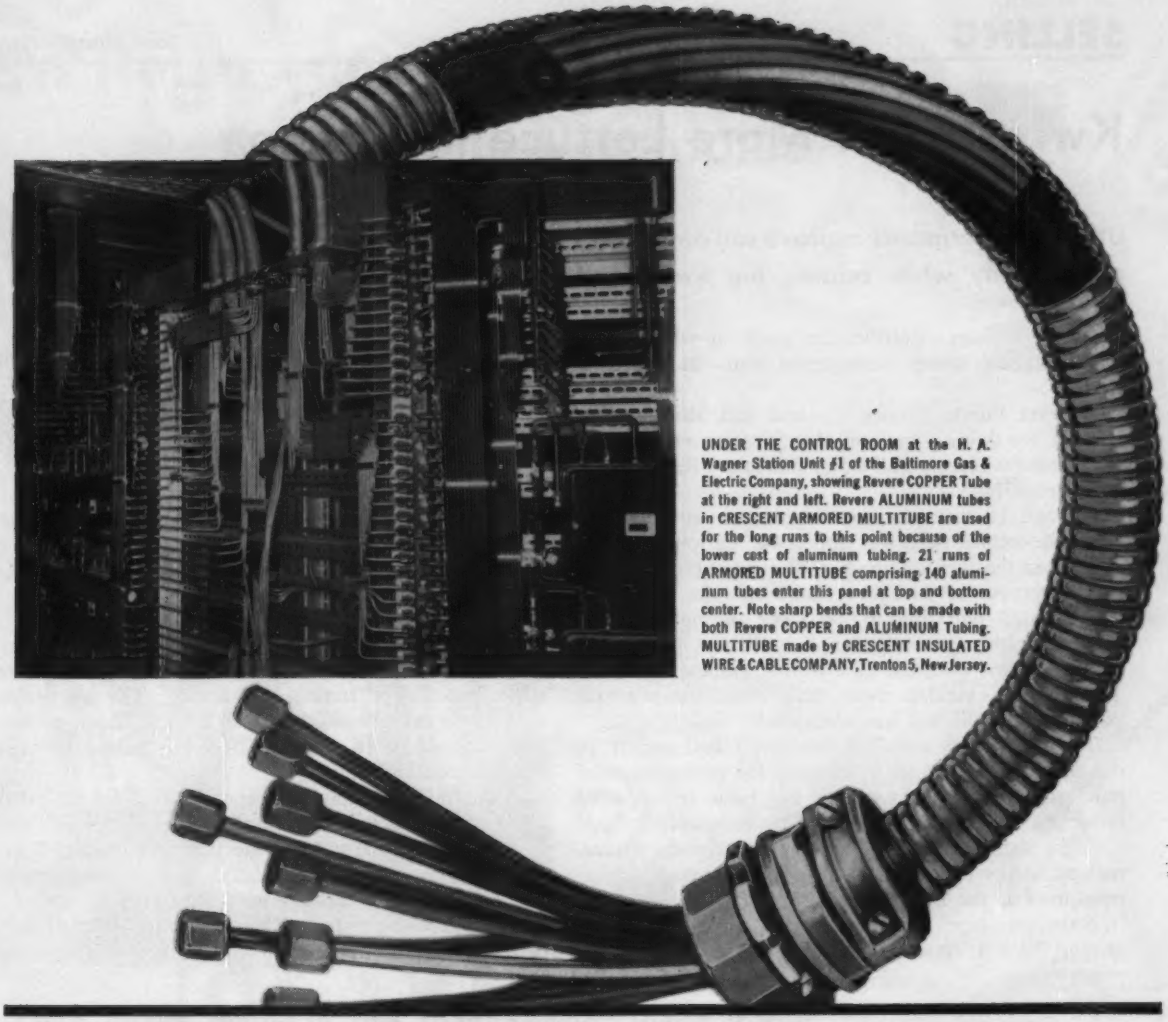
Bolted to the brake drum is a sprocket linked by a chain to another sprocket that rotates on the reel shaft. The latter is welded to an arm which has two movable dogs fitting into holes in the reel. These transmit the retarding force. Two movable, tapered bushings rotate on the shaft and center any size reel up to 5,500 lb net on the shaft.

To permit loading and unloading of reels the chain is longer than needed for drive purposes. Slack is taken up through an idler sprocket on a movable arm that can be pinned.

Although a hot stick controls hydraulic pressure in the brake, the trailer is grounded during wire pulling for greater protection of the operating groundmen.

Other features of the modified trailer include a mechanical screw jack on the front for support and to aid hook up, two support legs, and a trailer hitch on the back. The trailer hitch allows several reel trailers to be hooked together for simultaneous multi-phase stringing.

The Beaumont Division plans to have three such trailers. When not in use for 3-phase stringing, they will hold reels of different size aluminum conductor.



UNDER THE CONTROL ROOM at the H. A. Wagner Station Unit #1 of the Baltimore Gas & Electric Company, showing Revere COPPER Tube at the right and left. Revere ALUMINUM tubes in CRESCENT ARMORED MULTITUBE are used for the long runs to this point because of the lower cost of aluminum tubing. 21 runs of ARMORED MULTITUBE comprising 140 aluminum tubes enter this panel at top and bottom center. Note sharp bends that can be made with both Revere COPPER and ALUMINUM Tubing. MULTITUBE made by CRESCENT INSULATED WIRE & CABLE COMPANY, Trenton 5, New Jersey.

CRESCENT relies on REVERE

for dependable performance of its instrumentation and control tubing

REPORTS, "NOT ONE FAILURE."

The dependable performance of Revere Copper Tube in Crescent Armored Multitube*, ever since its inception, has led the CRESCENT INSULATED WIRE & CABLE COMPANY to fill its aluminum tube needs with Revere also.

In fact, Crescent, since it first started using Revere Copper Tube in 1953, reports not a single failure. And that's mighty important in instrumentation and control tubing service where utilities, chemical processing, petroleum, paper and similar industries can't afford the luxury of process failures.

Crescent Multitube, using either Revere Copper or Aluminum Tube, or both in combination, offers a completely protected installation for permanence, lower original installation cost, lower maintenance and a saving of time, space and money.

Crescent Armored Multitube consists of a group of Revere Copper or Aluminum Tubes, twisted together in cable form, protected by a flexible interlocked galvanized steel armor. Constructions are available employing plastic sheaths in combination with the armor for corrosive locations. Section of cabled tube pictured shows how Copper or Aluminum Tubes are encased inside the Armored Multitube. As many as 37 tubes of ¼" OD can be cabled in lengths up to 1,000 ft.

For details on Multitube write Crescent and for uniform quality copper and aluminum tube, speedily delivered, see the nearest Revere Sales Office.

*Reg. Trademark

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Rome, N. Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities, Distributors Everywhere.

Kwhrs Grow More Lettuce in Arizona

Utilities' experiments improve soil output and permeability while adding big kwhr load

Here's a farm electrification story in which more load definitely means more green stuff—in this case, lettuce!

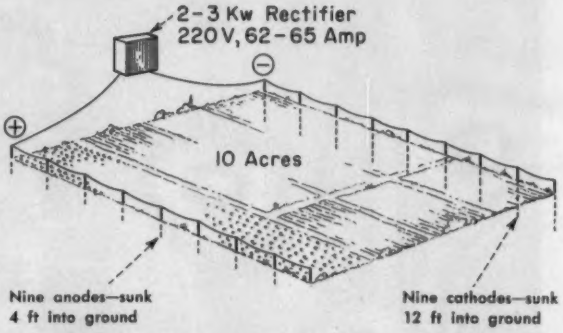
Arizona Public Service Co and Salt River Power District are doing some soil electrification experiments with Collopy Electro-Soil Co of Phoenix. Results have been promising.

On one 10-acre plot, considered the worst on the farm, the lettuce yield was upped 105 cartons per acre more than the surrounding non-electrified ground. This is an increase of 31.5%. But here's the best part: This treated plot used 6,686 kwhr during the year. Another plot, operating for less than a year, took 11,500 kwhr. A stand of Cardinal grapes, also on a 10-acre plot, yielded more than twice the previous pickings after the soil was electrified.

The program is aimed at reducing alkali content of the soil. It also wants to increase the permeability of hard-pan soils. Aside benefit has been an apparent reduction in root damage caused by nematodes.

Eight tests were conducted on land growing lettuce, melons, citrus fruits, wheat and other grains. Equipment used on the lettuce crop is typical:

Nine iron-pipe anodes are driven 4 ft into the ground 30 ft apart along one side of the 10-acre plot.



SOIL ELECTRIFICATION METHOD is simple and cheap. Plot needs only rectifier, wiring and iron-pipe electrodes

Nine cathodes are similarly placed along the opposite edge, but they're sunk 12 ft down. The electrodes are connected across a 220-v, 2-3-kw silenium rectifier. Seven to 16 amp at 62-65 v is passed through the field continuously.

After the lettuce plot was energized, it was irrigated along with the adjoining land. The electrified plot took 72 hr for saturation; the untreated land 36 hr. Bore samples from the treated land showed water penetration to 7 ft through hard pan clays.

There are eight test plots. Further tests should prove whether periodic soil electrification is necessary.

Water Role on Farms Is Buoyed-up

The importance of running water in building farm sales of power, pumps and appliances was stressed at the recent water supply conference in Minneapolis. Jointly sponsored by NEMA and Inter-Industry Farm Electric Utilization Council, the confab emphasized the "packaged" approach to water system planning. This "package" includes the pump, wiring, tank, plumbing—everything from well to faucet for modern living and farming.

According to R. W. Lewis, chairman of the Rural Load Development Subcommittee of NEMA's Farm and Rural Market Development Committee, "Running water under pressure is the first step to better rural living and farming." Farmers use water in virtually all their operations. At the going rate, it costs them $10.75 to pump and haul 400 gal of the stuff by hand. An electric system can do the job for about a nickel in power charges.

Farmers are going to have to go to power water moving, if they want to stay in business. Reason: the decreasing number of farms and the increasing population demands they boost productivity. Speaking on the subject "Farm Better Electrically—Install the Water System You Need," John Hosford of the National Association of Domestic and Farm Pump Manufacturers, pointed out that in 1930 each farmer fed and clothed 19 people; at present he is taking care of 28, and by 1975 he'll be caring for 55. More and better machinery, including electric water pumping systems, will help him.

The farm market potential, waterwise, looks pretty good. Once running water is installed, farmers start putting in appliances, like home laundry equipment. The faucet usually means about $750 in these appliances and another $2,000 in water equipment on the farm. There's more than 1½ million farms in U. S. plus many non-farm rural homes without running water.

Electric Bed for 'Taters

Down in Thomas, Okla., sweet potatoes begin life warmed by an electric blanket. Resistance-heated beds hasten their incubation period. After the seedlings are established, they are removed and sold to commercial growers. The beds are on Public Service Co of Oklahoma's lines.

(More Selling on page 99)

NEW Holan derrick "stretches" to handle long poles

Lifts heavy loads in low ranges, body-loads 4,000 pounds, comes low enough to power-feed diggers

No conventional derrick, this one. It has an extendible boom head that "stretches" the derrick an extra five feet (to 28 feet high) for handling poles up to 75 feet long. Yet, with boom head extended, little lifting capacity is lost. In a position about 10 degrees off vertical, it lifts 8,000 pounds; with boom head extended, it still lifts 6,000 pounds.

Two sets of cylinders provide greater lifting capacity in low ranges. Auxiliary lift cylinders raise the derrick almost to vertical, then the main lift cylinders take over.

Three other important features: (1) You can body-load 4,000 pounds (2) You can bring the derrick low enough to use digger power feed attachments (3) You can operate more safely by checking the new easy-to-read load indicator which gives capacities at all derrick positions.

Like other Holan derricks, this one is made of high-tensile steel and fits any body on its own supports. It also has Holan's lighter-but-stronger fabricated side legs. We'd like to tell you more. Write and ask about the Holan Series 6800 Power Derrick with or without Extendible Boom Head.

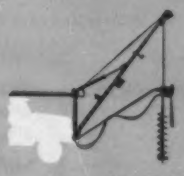
All Holan bodies are made of hi-tensile, rust-resistant steel 20 to 25% lighter than ordinary steels.

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Service bodies for chassis up to 1½ ton. Lengths, 72", 84" and 102".

Aerial arm for spotting workmen 37 feet above ground, 9 feet below ground level. Double-basket unit extends 45 feet. Rotates 360°.

Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.



Portable hydraulic and mechanical earth borers. Augers for 8" to 20" diameters, depth to 8'.

Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

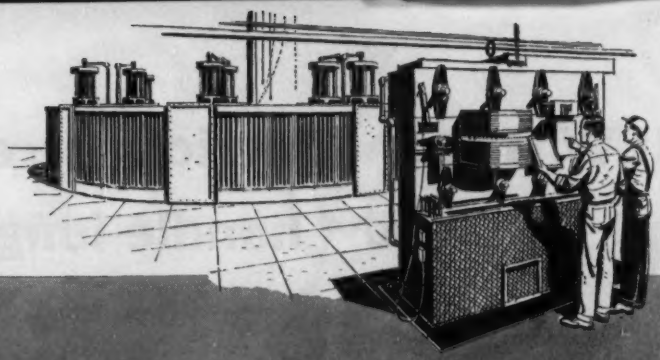
J.H. HOLAN® CORPORATION

4100 WEST 150TH STREET
CLEVELAND 11, OHIO

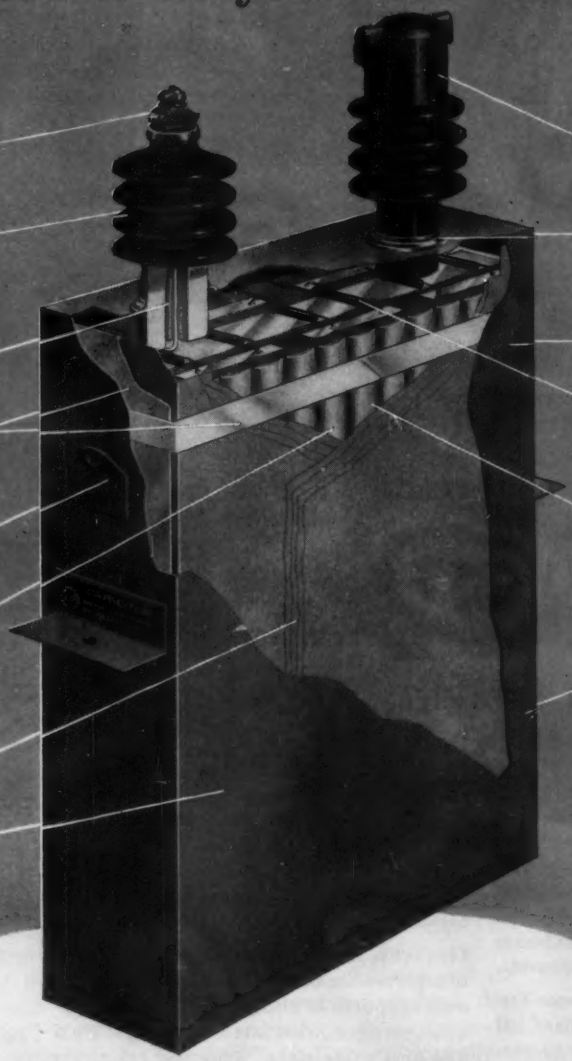
OTHER PLANTS:

HOLAN CORPORATION OF GEORGIA, Griffin, Ga. • J. H. HOLAN CORP., Phoenix Div., Arizona
BRANTFORD-HOLAN LIMITED, Brantford, Ontario

THE NAME THAT MEANS WORK SIMPLIFICATION



Based on 10 years of Betatron experience



Convenient 2-piece parallel cable connector

Heavy duty multi-petticoat wet-process, glazed porcelain bushing with integrated solder seal.

Dykanol-filled bushing *

Pressure equalizing band and rigid individual plates assure uniform capacity.

Side dual lifting lugs avoid flashover danger.

High impulse level is the result of wide margins between paper and foil, coordinated with major insulation.

Multi-laminated case liners.

Stainless steel cases optional.

One piece moulded insulating terminal caps optional.

New type, one piece solder seal design assures permanent hermetic seal.

More durable case

Multiple resistor individually wired for maximum security.

Lowest volts per mil; lower operating temperature and power-factor; are the result of C-D's conservative, field-proved engineering principles.

Only C-D capacitors are quality control-tested at full voltage for a period sufficient to reach terminal stability.

Here's why C-D Capacitors consistently exceed all field performance requirements:

• Lowest dielectric unit stress and highest major insulation level. • Dykanol-filled bushings increase accepted flashover safety-factor, insure high level of impulse withstand. • Removable solderless connectors. • Many sections in series-parallel connection. Extremely low voltage gradient per section; less heating; no corona; longer life; lower power-factor. • Discharge resistor connected to each series section, instead of terminal to terminal. Provides effective discharge for each series group and balanced voltage distribution. • Side mounted lifting lugs — stronger and avoid risk of flashover. • Energization tested, 100 percent, to assure uniform distribution of low dielectric losses.

*DYKANOL®

C-D now introduces a

NEW 50 Kvar CAPACITOR

CORNELL-DUBILIER'S NEW 50 Kvar power capacitors provide the same matchless degree of reliability that customers have enjoyed from C-D's entire power capacitor line for so many years. A special 45 Kvar Betatron type of capacitor in continuous production from 1947 to date has established the unquestionable superiority of C-D's field proved conservative engineering principles. These result in capacitors with the lowest volts per mil (333) and power losses much lower than the NEMA limit of 3⅓ watts per Kvar. That's why you get more power capacitor value with C-D's.

See for yourself the built-in extras you get in C-D 50 Kvar units. These are your guarantees of performance beyond the usual one-year period. Insure low-maintenance service from your next power-factor installation, by talking it over first with a C-D engineer. Just write to Cornell-Dubilier Electric Corporation, Dept. D-57, South Plainfield, New Jersey.

CORNELL-DUBILIER
power-factor capacitors

SOUTH PLAINFIELD, N. J., NEW BEDFORD, WORCESTER & CAMBRIDGE, MASS., PROVIDENCE & HOPE VALLEY, R. I., INDIANAPOLIS, IND., SANFORD, FUQUAY SPRINGS & VARINA, N. C.; VENICE, CALIF., & SUB.: THE RADIART CORP., CLEVELAND, OHIO; CORNELL-DUBILIER ELECTRIC INTERNATIONAL, N. Y.

LIVE BETTER ELECTRICALLY

LBE Notes

Retailer's Kit Available

A new "Live Better . . . Electrically" retailer's kit is now available. Designed to help the dealer tie-in with current national and local campaigns, the package will be handled through utilities and appliance distributors. It contains store and window display materials and newspaper ad mat proofs with which a dealer can coordinate better his own promotion schemes with those of his utility, his manufacturers, and his trade allies.

Kit features a 28-page ad mat book titled "Advertising Aids for Electrical Retailers." It's got more than 120 tips on how to use the "Live Better Electrically" theme.

Another kit highlight, and one that is going to be a recurrent theme in future LBE promotions, is the "Rate Yourself" sheet. Mrs. Housewife is asked to check which of 33 listed appliances she has in her kitchen, and on that basis, to rate her kitchen as "just wonderful," "enjoyable," "bearable," or "roughing it."

Macy's First in LBE Push

R. H. Macy & Co staged the biggest retail Live Better Electrically promotion to date recently in its six New York City department stores. The promotion was a week long.

The Macy push was the first tie-in by a major department store with LBE. Idea, according to Macy prexy Elliot Water, is ". . . in the belief that the market for electrical home equipment is expanding rapidly, and that department stores, through special promotions, can obtain a larger share of this growing market." The Borden Co cooperated by having its demonstrators cook Borden recipes on electric ranges and ovens in the Macy stores.

(More Selling on page 100)

Radiant ceiling cables . . .

and a heat pump are . . .

Separate Systems in Heating & A.C. Test

Yankee ingenuity is at it again! This time it's working in electric house heating.

To collect information and data on the possibilities of electric heating in its area, Narragansett Electric Co of Providence, R. I., built an all-electric home, and installed not one, but TWO complete, independent electric heating systems.

One system is made up of heating cables imbedded in ceiling plaster, chosen because it would least interfere with the duct work of the second forced air system. This second system is a central water-source heat pump with a heating capacity of 42,000 Btu/hr using 50 F water, supplemented with 12 1-kw hairpin resistance units located in the ducts. However, only two 3-kw combinations are connected. Humidity control is provided by a humidistat. The water source-unit was selected because (1) a good 50 F source was available, and (2) Narragansett felt it was simpler to operate.

Radiant System Full Capacity

Full capacity radiant ceilings have been installed throughout the living spaces except in two small lavettes. Ceiling areas here were too small. Baseboard units were used instead. Total normal heating capacity is 16 kw. The basement is normally unheated, but it has two manually operated heaters totalling 5 kw for use when heat is necessary.

Insulation wasn't overlooked. Batt type mineral wool with vapor barrier was installed. Six in. went in the ceiling, 3 in. in the side walls, and 2 in. between heated and unheated spaces. Windows are all double-glazed and weatherstripped. Storm doors have been added.

Service entrance is 120/240 v. There is the usual billing meter. In addition, the heat pump, supplemental units and the radiant ceilings are metered separately for kwhr and kw indicating chart (15 min demand).

Idea is to Get Comparison

The idea of the two-system house is get the cost of installation, operation and maintenance of both systems, and evaluate their relative features. In New England, where electric space heating runs sparse and thin, little is known about its effects on utility distribution systems and their economics. Narragansett feels they'll pick up something along this line also.

The house has recently completed its first winter. As yet, data has not been correlated. When this information is available, along with that of the summer heat pump operation, a more detailed report will be forthcoming.

Heat Pumps Installed in Jefferson Memorial

Heat pumps have gone to Washington. Five units, GE Weathertrons, have been installed in the Jefferson Memorial.

This marks the first time that heat pumps have been used in a national shrine. They heat and cool the historian's office, lecture hall, guard rooms, souvenir shop and wash rooms.

Jefferson Memorial was formerly heated with steam. In upgrading and reconditioning the memorial, government engineers decided that a new heating system was needed. At the same time it was decided that cooling would be a desirable addition, and heat pumps provided the logical answer.

The units are installed in a subterranean area below the open rotunda, and the "outdoor" air used is drawn from this cavern-like enclosure.

H & C BRIEFS

• Electric heating of homes will nearly double by 1960, C. C. Brissenden, Portland Electric Co general sales manager, told a convention of the Pacific Coast distribution division of Oil Heat Institute of America. He said there were 300,000 electrically-heated homes by the end of 1956, and that there will be 560,000 by 1960 and 1,850,000 by 1965.

• Kansas Power & Light Co has added a new electric heating rate to promote the all-electric home. All kwhr used in excess of 1,000 per month will be billed at 1.25¢. The new rate is effective through the heating season—Nov. 1 through May 31 inclusive.

• Use of air conditioning in the textile industry is spreading rapidly, according to a recent article in the Journal of Commerce. The industry is investing $20 million a year in A.C. equipment. This results in big savings by eliminating shutdowns and increasing efficiency.

(More Selling on page 104)

Photograph courtesy The Rumar Heating Company

Here Is Heat...
That FITS a Family!

Glass panel radiant heat lets you offer *individual* heat control for every room, every member of the family. It's fast, draft-free, and clean. Maintenance is no problem because there are no moving parts to break down. No wonder home owners like it!

Builders and architects like it, too. This heat simplifies building and remodeling and cuts costs. No ducts, no furnace, no chimney. Glass panel heat is the modern way to heat private homes, offices, motels, apartments, commercial establishments.

It's a fast-growing business, and leading the parade are Blue Ridge Ra-Grid® Heater Plates. Time-tested (for over a decade), more Ra-Grid panels are in service than any other make . . proof of their superiority, acceptance and on-the-job dependable performance. Look for "Ra-Grid" imprinted on each panel. Write Dept. HP-4357 for detailed information and names of fabricators of the finished units.

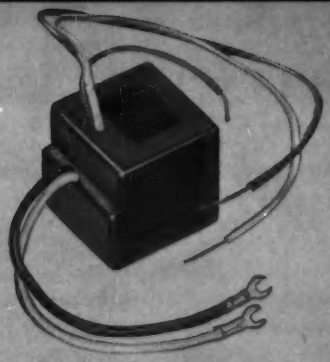
BLUE RIDGE GLASS CORP.

KINGSPORT, TENNESSEE

Creative IDEAS *in Glass*

LOOK TO SANGAMO FOR DEMAND

thermal .



Encapsulated coil assures maximum protection from lightning and high voltage surges. The potential transformer coil of the demand element is encapsulated in a specially developed epoxy resin with extremely high dielectric strength. Thus, the insulation levels of the demand element and the watthour meter element in these combination meters are equally high.

LINCOLN DEMAND METERS

Lincoln J2T thermal-demand watthour meters combine ± 2% full scale accuracy with exceptionally trouble-free performance to provide long life, low-cost demand measurement. Only two operating adjustments are necessary.

The J2T is ideally suited for application to singlephase residential and commercial loads. It is supplied with scale values of 12 KW, 24 KW, and 48 KW to take full advantage of the capacity of J2 Watthour Meters. A 12/24 KW or 24/48 KW scale is available for growing loads.

Other Lincoln Meters are available for polyphase demand measurement. Send coupon at left for complete technical information on Lincoln Meters and how they fit every application for billing measurement—singlephase or polyphase.

SANGAMO ELECTRIC COMPANY, Springfield, Illinois.

Please send complete information on Lincoln Thermal Demand Meters.

Name_____

Company_____

Address_____

City_____ State_____

SANGAMO ELECTRIC

MEASUREMENT

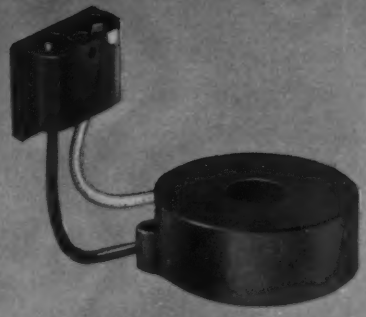
mechanical

SANGAMO DEMAND REGISTERS

Sangamo Mechanical Demand Registers, both singlephase and polyphase, are built to give many years of dependable service within the guaranteed accuracy limits of ± 2% full scale. Only two adjustments, zero setting and idle pointer friction, are required.

The long service life of these demand registers is due to: 1. The Sangamo slow-speed, high torque motor; 2. The timing gear shafts with hardened, polished *stainless steel* pivots which turn in lifetime-lubricated porous bronze bearings; 3. The use of jeweled and nylon thrust bearings; 4. The dependable, clutch-free, gravity reset mechanism.

Both the JH2 (Singlephase) and LCH2 (Polyphase) registers can be field-installed on any modern Sangamo Watthour Meter without recalibration. Send the coupon at right for complete information on Sangamo Mechanical Demand Registers.



The heart of the Demand Register is the *timing motor*. The motor coil of the Sangamo Type H Motor is encapsulated in a specially developed epoxy resin with voltage breakdown in excess of 10,000 volts. The motor operates at slow speed, only 450 rpm. Special silicone grease packing permits stable operation from −50° to 250° F.

COMPANY *Springfield, Illinois*

SANGAMO ELECTRIC COMPANY, Springfield, Illinois.

Please send complete information on Sangamo Demand Registers.

Name_____

Company_____

Address_____

City_____ State_____

SM57-3

Modernization Cracks Production Bottleneck

GLEN J. ALDEN, Industrial Sales Engineer, Minnesota Power & Light Co, Duluth, Minn.

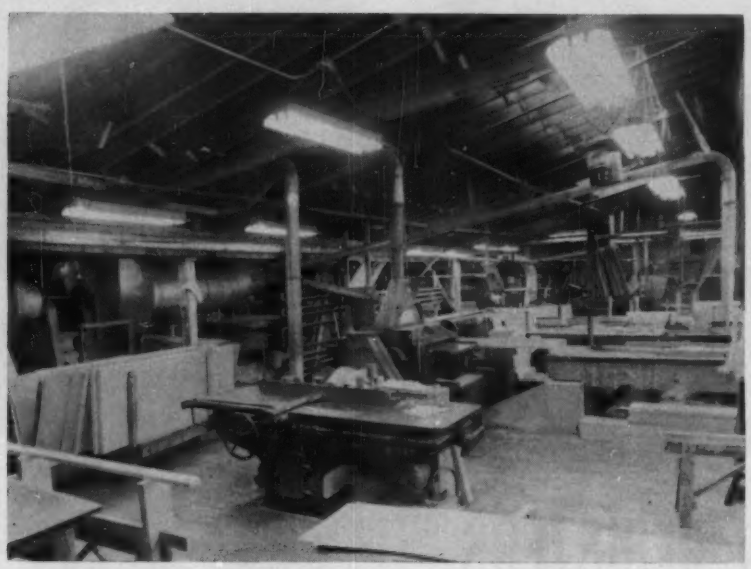
Mechanized production and a new lighting system smashed a production bottleneck and improved plant efficiency at the Woodruff Lumber Co, Duluth, Minn. Operating both a lumber yard and a woodworking plant specializing in fine cabinet and millwork, the company now has sufficient power even at high production periods. And the new fluorescent lighting system has boosted the lighting level approximately 300 percent. Moreover, noise and vibration in the production areas has dropped sharply.

Mechanizing the shop meant installing a total of 389 hp in individual motors, ranging from five to 100 hp in size. Most of the load is in such applications as planers, timber servicers, and blowers.

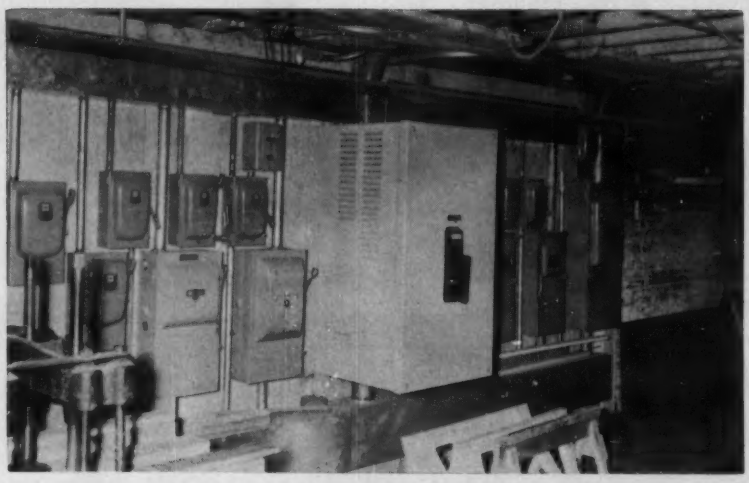
The 35-kw lighting installation consists of 200, two-tube, four-foot industrial fixtures, supplemented with incandescent lighting. New lighting increases the minimum lighting level to 40 foot-candles, compared to approximately 3 foot-candles with the previous equipment. All lighting is operated from 480/120-v dry-type transformers located in load centers throughout the plant.

Before the new motors were installed, the principal source of power was a 150-hp Corliss steam engine which could not supply sufficient power to the line shaft during high production periods. In addition, it created a high noise and vibration level which could be heard and felt throughout the building.

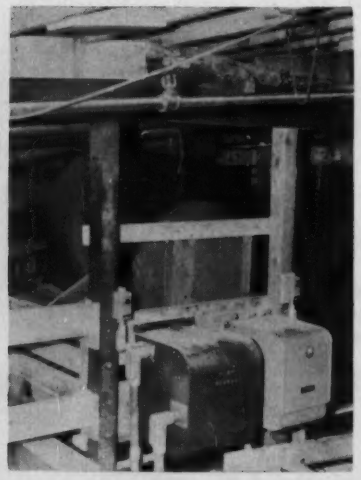
A new substation with 350-kva, 14-kv primary to 440-v secondary transformers was installed. This supplies all power to the Woodruff Lumber Co. Distribution voltage in the plant is 480 v, with dry-type transformers in load centers to supply the 120-v requirements. The Corliss steam engine has been removed and sold for junk.



Relighted and mechanized wookworking shop . . .

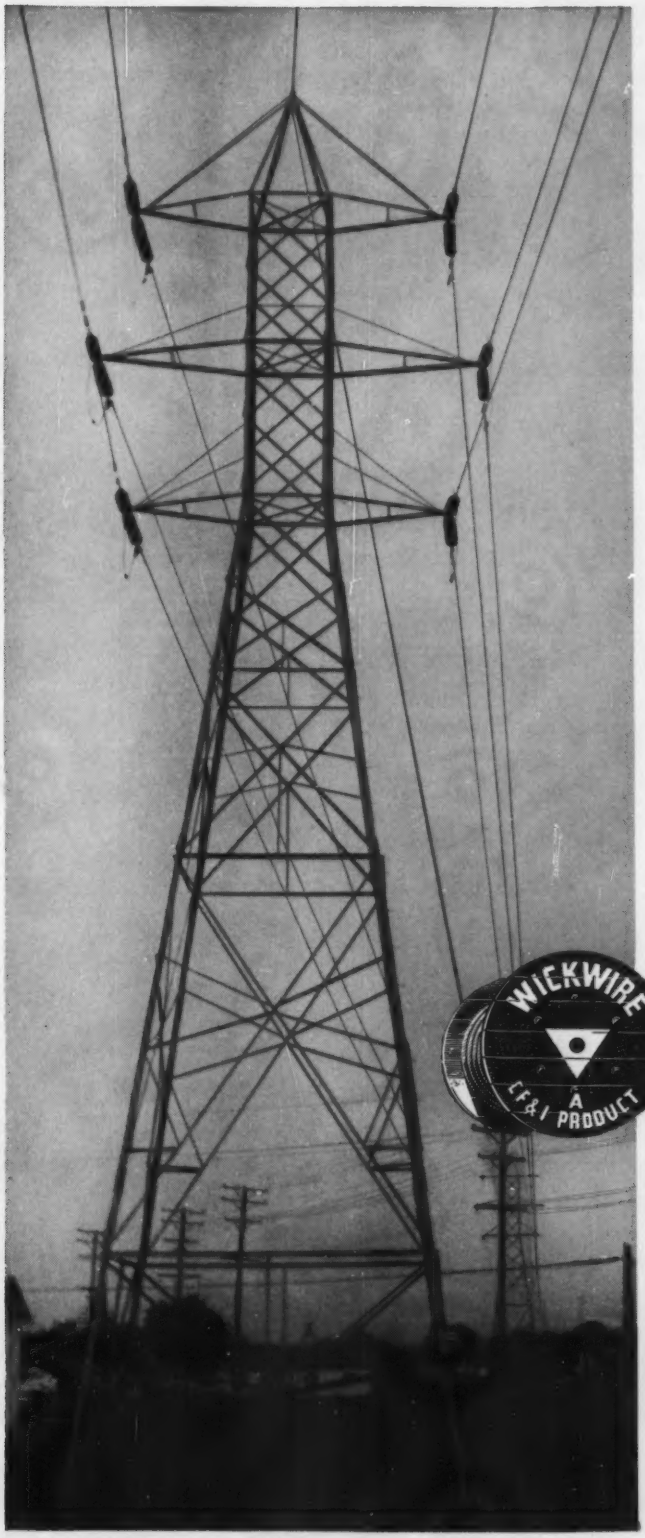


. . . boasts compact load center distribution, . . .



. . . modern motor control.

CF&I GALVANIZED STEEL STRAND



for guy, messenger and overhead ground wire . . . quickly available from both eastern and western plants

No matter what part of America you're in, CF&I can quickly supply your needs for top-quality, guy, messenger and overhead ground wire. That's because three- and seven-wire CF&I Galvanized Steel Strand is made at both Buffalo, N. Y., and Pueblo, Colo.—a combination of plant sites that's ideal for speedy, nationwide distribution.

What's more, you can be sure of the quality of CF&I Galvanized Steel Strand because every phase of its production is supervised by the manufacturers of world-renowned Wickwire Wire Rope and Wire Rope Slings.

Next time you need strand—whether it's to your own specifications or to ASTM Specifications A-122 or A-363—be sure you explore the many advantages offered by CF&I Galvanized Steel Strand. Better still, contact your nearby CF&I representative today.

GALVANIZED STEEL STRAND

THE COLORADO FUEL AND IRON CORPORATION

Albuquerque • Amarillo • Atlanta • Billings • Boise
Boston • Buffalo • Butte • Chicago • Denver • Detroit
El Paso • Ft. Worth • Houston • Kansas City • Lincoln (Neb.) • Los Angeles • New Orleans • New York
Oakland • Oklahoma City • Philadelphia • Phoenix
Portland • Pueblo • Salt Lake City • San Francisco
Seattle • Spokane • Wichita

CF&I OFFICES IN CANADA: Montreal • Toronto

4267

the BIG, strong,

You can barely hear these

whispering 4000-hp Allis-Chalmers 2-pole motors

driving boiler-feed pumps at Detroit Edison's River Rouge Plant

Kilowatt output at River Rouge is at a record high — yet things are pretty quiet — especially in the neighborhood of these big 4000-hp, 4000-volt, 3580-rpm Allis-Chalmers motors. Gone is the irritating whine of high speed motor operation — these boiler-feed pump drives just whisper while they work.

Practically all of the mechanical noise has been engineered out by Allis-Chalmers. Special design of the rotor has eliminated much of the noise at its source. This, along with significant modifications in stator design, has resulted in almost unbelievable reductions in sound level. Air inlets have been located away from fans. Noise generated in the motor is now channeled through a lengthy path of acoustically-designed vent passages. Sound-deadening and sound-absorbing materials are used to remove noise before it can be transmitted to the outside.

Other features for dependability and low maintenance

All the advantages that have contributed to the outstanding reliability of Allis-Chalmers 2-pole motors have been retained. In addition, the following new features have been incorporated:

Top Air Intake (available with filter) permits hosing down motor area: motor does not pick up floor dirt.

Top Air Discharge adds to personnel safety and comfort.

Spiral Ventilation provides uniform cooling; aids noise reduction.

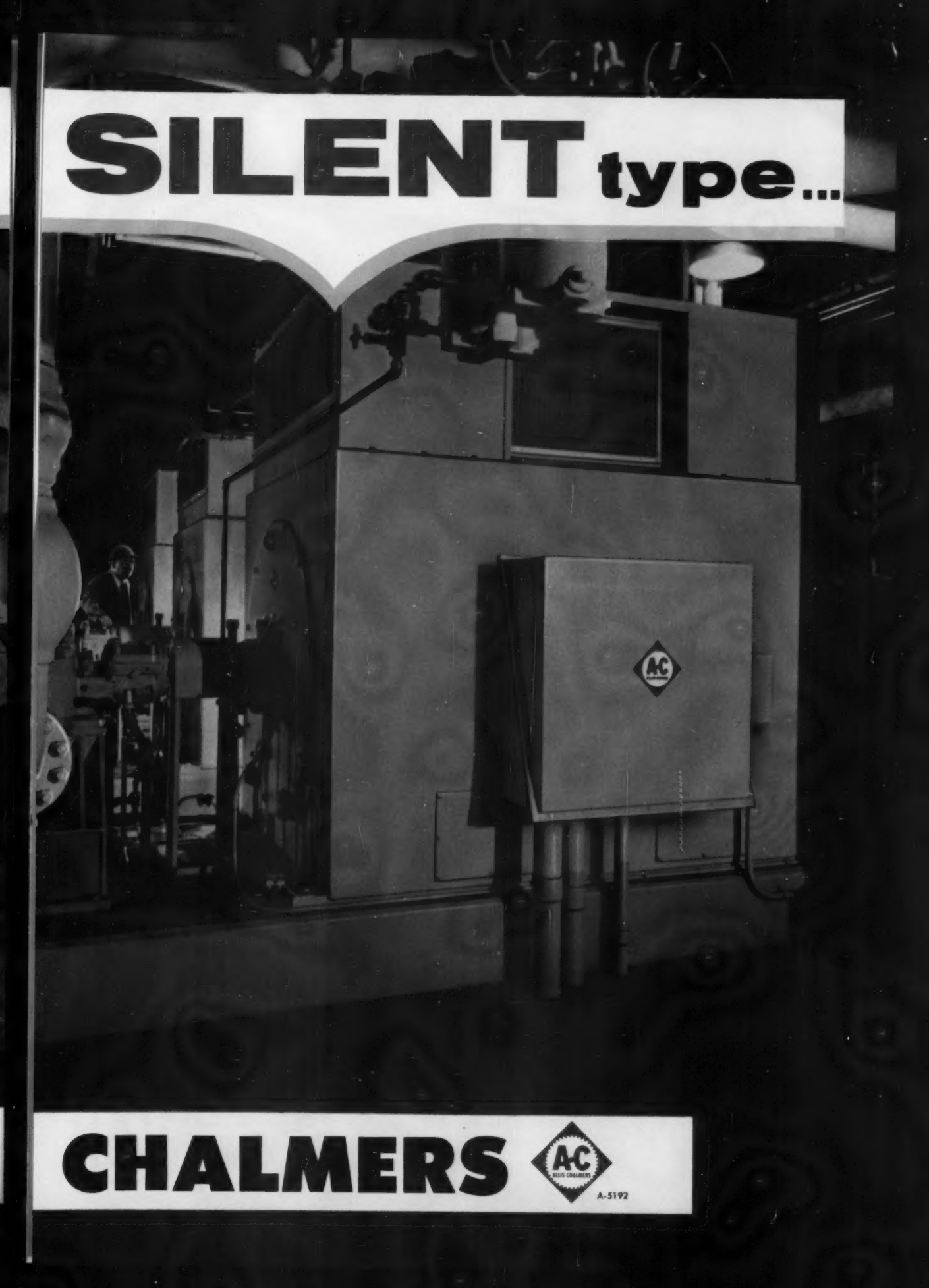
Improved Bearing Design prevents oil leakage, simplifies maintenance. Capsule-type housings permit inspection of windings without exposing bearings.

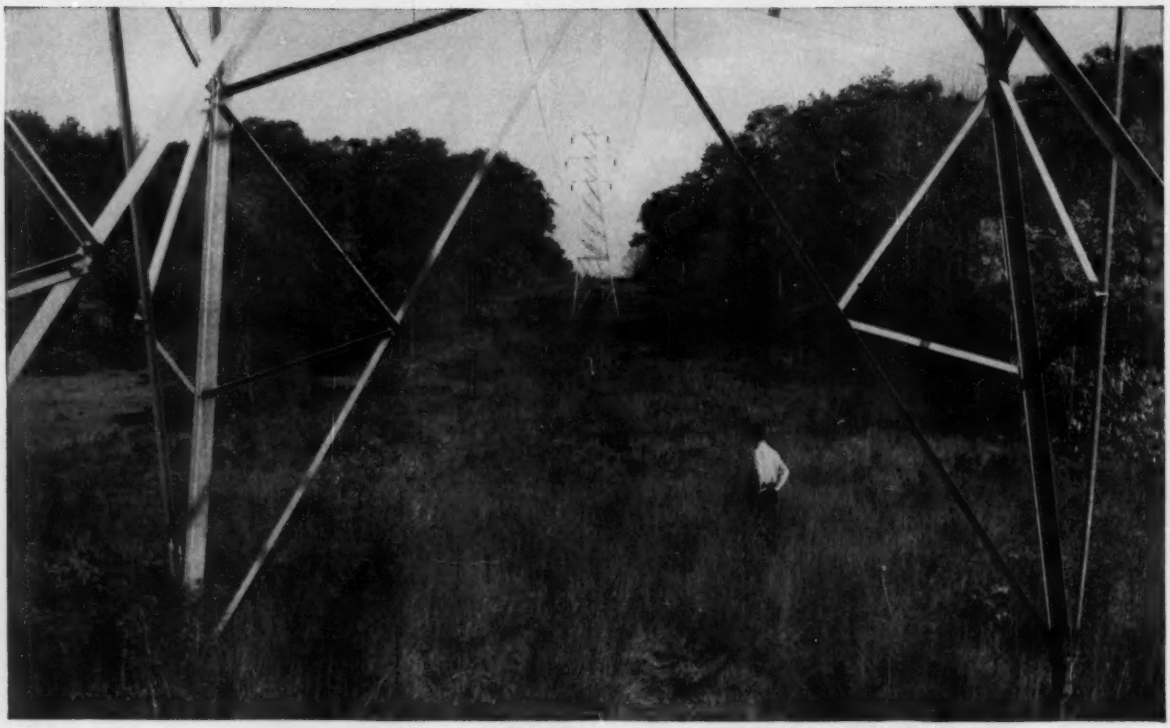
Sound-Engineered Motors speak for themselves — but softly. Acoustic design, affirmed by continuing user satisfaction, was first proved by test analysis of noise frequency levels on these motors.

- Half octave band frequency analyses showed no objectionable levels at any point on the noise spectrum.
- Test readings remained remarkably low, even at troublesome high frequencies.
- Results showed that conversations next to the motor could be carried on without effort.
- Noise level is so low that these motors would be good neighbors in any powerhouse.

Allis-Chalmers 2-pole motors in this design are available in ratings 900 hp and larger. For complete information, see your A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-


SILENT type...
CHALMERS
A-C
ALLIS-CHALMERS
A-5192



• Brush control with "Ammate" three growing seasons after application! This Rockland Power and Light right of way was originally 100% brush. Photograph taken October 1956.

Why it pays to control brush with Du Pont AMMATE® X

WEED AND BRUSH KILLER

"Ammate" X is not volatile! . . . You can use "Ammate" on rights of way, even when they adjoin cropland planted to sensitive crops like cotton, soybeans, tobacco and peanuts.

"Ammate" X assures lower-cost, longer-term brush control . . . When the original spray job is done well, only occasional spot sprays are required to keep brush under control for years.

"Ammate" X kills roots of brush as well as tops . . . yet allows low-growing natural cover to come back.

"Ammate" X as a foliage spray . . . Kills more kind of brush and keeps it down longer than any other known herbicide.

"Ammate" X is easy to use . . . can be used without hazard to applicators, livestock or wildlife, as well as to nearby crops.

Earl Tomes, Manager
Taylor County REA
Campbellsville, Ky.
says:

"We have been using 'Ammate' for five years. We have found it to give the best kill of all type chemicals we have used. Another reason we use this chemical is due to the fact that in our area we have so much tobacco and so many tobacco beds that during the spraying season we can hardly use any other type. In our five years of using 'Ammate' we have not had a single off the right-of-way complaint or claim for damages."

WHERE WEEDS AND GRASS ARE A PROBLEM, you can rely on Du Pont "Telvar" weed killers for season-long control. Use "Telvar" around substations, pole yards and other areas where maintenance is tough and costly. Low dosages do the job. "Telvar" weed killers are wettable powders, are non-flammable, non-volatile, non-corrosive and low in toxic hazard.

On all chemicals follow label instructions and warnings carefully.

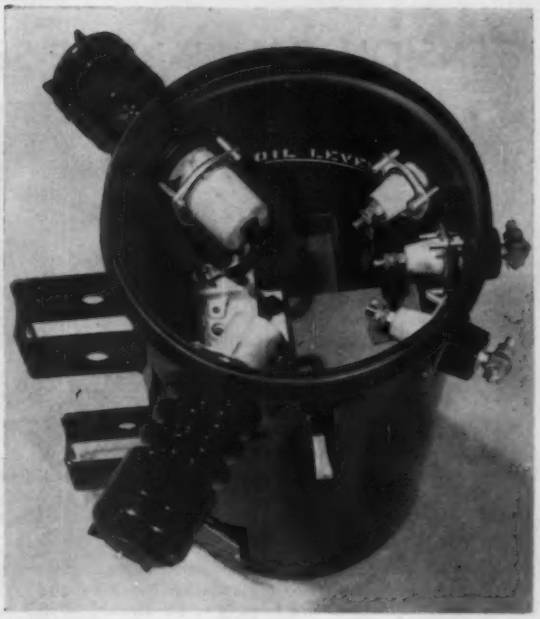
DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

NEW EQUIPMENT

Distribution Transformers

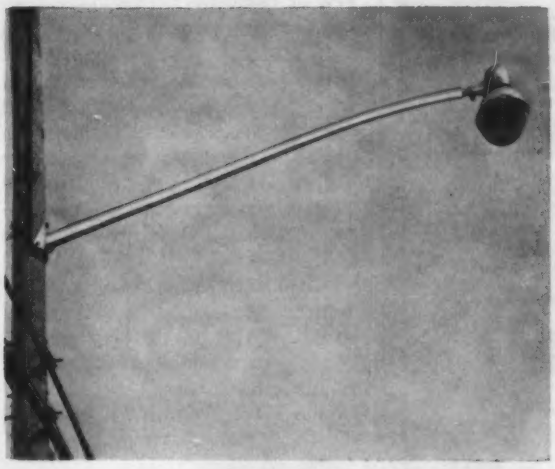


A line of oil filled, 60-cps single-phase distribution transformers, designated Type OS, is available for pole mounting in both city and rural areas. They are said to be light weight and small in size. Magnetic core is reported to be high permeability, grain oriented steel, wrapped in special configuration.

Immediately available sizes include 2400/4160Y-120/240-v units rated 5, 10, 15, 25, 37.5, and 50 kva. Units rated 10 kva and above have four 2.5% below taps. Other models to 167 kva and 15 kv will be available.

Welded steel tank is gasketed to exclude moisture, and has corrosion resistant paint. Units have side-tank and cover bushings.

Delta-Star Electric Div, H. K. Porter Co, 17 & Cambria St, Philadelphia 32, Pa.



Lighting Bracket

This 10-ft aluminum tapered, elliptical lighting bracket has no external tie rods or sway braces but is said to withstand 100-mph wind loadings. The mounting plate is small in area and requires only one through bolt and two lag screws to install.

It is said to be quickly and easily installed. Manufacturer claims it requires no painting or maintenance.

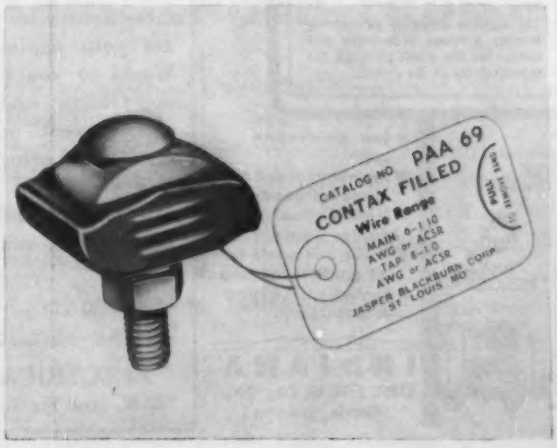
Pfaff & Kendall, 84 Foundry St, Newark, N. J.

Prefilled Clamp

Prefilled with Contax oxide inhibiting compound, these parallel groove clamps reportedly eliminate possibility of forgetting to apply inhibitor to connections and conductors. Compound is sealed in a plastic band which is removed by a tear string at installation time. Pull tag on free end of string shows catalog number and wire range.

Clamps accommodate the popular range of conductors No. 6 AWG to 1/0 ACSR on both sides as well as other sizes and combinations of sizes. They are available in aluminum to aluminum, copper to aluminum, and general purpose types.

Jasper Blackburn Corp, 35 Madison St, St. Louis 6, Mo.



(More New Equipment on page 110)

TENSION GAUGE is PRE-SETTABLE

For GO/NO-GO Tests of Springs and Contact Pressures

Speedy, one-hand operation and precise calibration over a range of 4 to 2500 grams, with adjustable zero setting, are the important features of GENALEX tension gauges. Designed for GO-NO-GO checking of spring tensions or other resistive forces, these gauges permit inspection or production testing by unskilled personnel.

To use this gauge: just preset the tension by turning the micrometer knob until the pointer shows the desired tension on the scale and apply the tip of the gauge-operating strip where force is to be checked. If the force being checked matches the gauge setting, the operating strip and the resisting element will move at the same time. Attention is focused on one point only—movement at the point of contact: there are no dials or scales to be read.

Six models are available, covering ranges of 4-24, 10-80, 50-250, 100-500, 200-1600, and 500-2500 grams. For detailed descriptive bulletin and prices, write: General Electric Company, Limited of England, c/o Imtra Corporation (U. S. Agents), 11 University Road, Cambridge 38, Massachusetts.

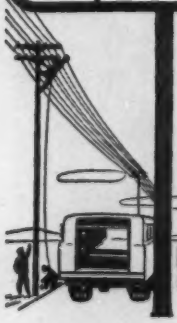
INDIANA STEEL & WIRE CO. Crapo Galvanizing MUNCIE, IND.

Signs along the lines of *Crapo* GALVANIZED STEEL STRAND PERFORMANCE

For dependable performance . . . insist upon *Crapo* Galvanized Steel Strand. Superior tensile strength, combined with long-life, ruggedness and workability, makes *Crapo* Steel Strand first choice for guys, messenger and overhead ground wire.

The famous *Crapo* galvanizing process provides dependable protection for the steel, prolongs the expectant life of the strand.

- Low maintenance cost
- Laboratory tested and controlled quality
- Meets highest quality standards
- A size and grade for all practical needs
- Contact your *Crapo* Jobber Today!



INDIANA STEEL & WIRE CO., INC. Muncie, Indiana

Don't Get Lost . . .

If you change your address, remember to wire us in. We can't get your copies of Electrical World to you promptly if we don't know where you are. It will prevent other important mail from going astray if you give your local postmaster the word, too. He'll thank you, we'll thank you, and you'll thank yourself.

Send your old and new address to:
Subscription Department
ELECTRICAL WORLD
330 W. 42nd St., New York 36, N. Y.

Fuse

Designated 9F9D-9, a high voltage fuse said to have 3.3 times the 60-cps interrupting capacity of its predecessor is now standard equipment on stack rack capacitor equipments using 50-kvar units. Rated 8.7 kv and 4,000 amp, it has a fiber glass wall which reportedly assures high mechanical strength and resistance to the elements. Manufacturer claims design provides satisfactory operation when stored energy of adjacent capacitor is 5 times that previously permitted.
General Electric Co, Schenectady 5, N. Y.

Off-the-Road Trucks

Designed chiefly for off-the-road use, 4-wheel drive Power-Wagons are available in three additional models: The W500 has a maximum gvw of 18,000 lb with either a 130-hp, 6-cylinder engine or a 197-hp, V-8 engine. Wheelbase may be 156 or 174 in. Front-mounted winch has 5-ton pulling and hoisting capacity, and 250 ft of $\frac{7}{16}$-in. cable.

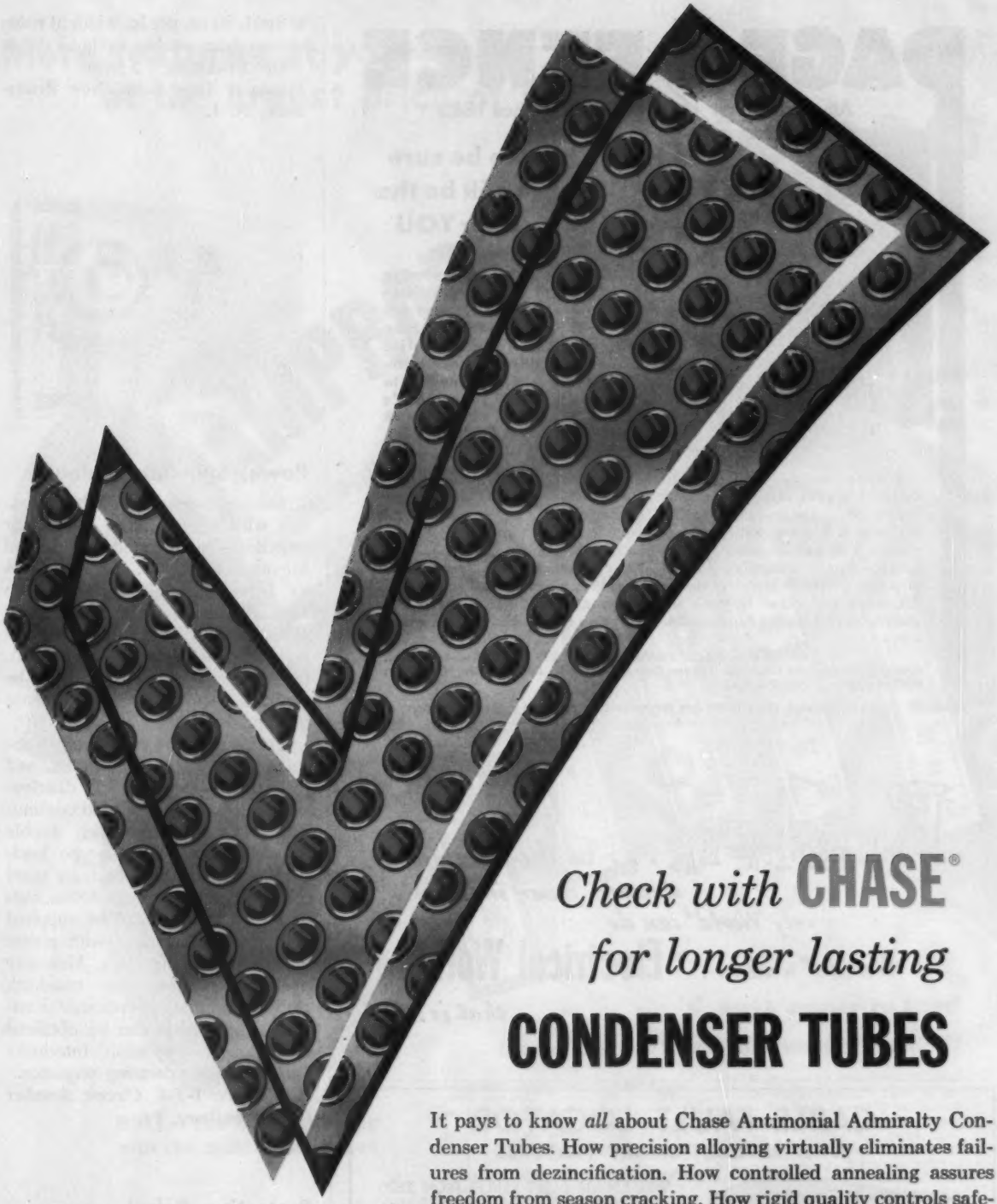
The W100 has a maximum vehicle weight rating of 5,100 lb and either a 120-hp, 6-cylinder or a 204-hp, V-8 engine. Wheelbase may be either 108 or 116 in. The W200 has a 116-in. wheelbase, a maximum vehicle rating of 8,000 lb, and either a 120 or 204-hp engine. Winch capacity on the W100 and the W200 is 8,000 lb.
Dodge Truck, Detroit 31, Mich.

Glass Tape

A heat curing glass cloth electrical tape, type 212, is offered for Class H insulation and for high temperature multiple winding insulation. The adhesive is said to function effectively in temperatures from −65 F to +650 F. Silicone glass reportedly resists corrosive action at high temperatures.

Tensile strength of 153 lb per in. is claimed. Insulation resistance is said to be 500 megohms at 96% relative humidity. Other reported specifications are: dielectric strength, 3,000 v; elongation, 6%; adhesion

(*Continued on page* 112)



Check with **CHASE**®
for longer lasting

CONDENSER TUBES

It pays to know *all* about Chase Antimonial Admiralty Condenser Tubes. How precision alloying virtually eliminates failures from dezincification. How controlled annealing assures freedom from season cracking. How rigid quality controls safeguard your investment. Yes, it pays to know about Chase! Pays off in lowered operating costs...fewer breakdowns...more time between replacements! Find out! Check with Chase today! Write for your free 54-page manual: *"Chase Condenser and Heat Exchanger Tubes."*

Chase
BRASS & COPPER CO.
WATERBURY 20, CONNECTICUT
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper and Stainless Steel
Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L. I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

PAGE chain link FENCE

America's First Wire Fence—since 1883

Here's how to be sure PAGE Fence will be the RIGHT Fence for YOU

You are invited to write for a file-size folder packed full of information that's essential when making decisions leading to the fence that's BEST FOR YOU. Ask for Folder DH-26.

• When you need a fence it will be much to your advantage to have full knowledge of the many choices of component parts that PAGE provides. You can choose from 8 heights—4 fabric metals—2 types of metal posts—6 styles of gates. All these and other features are pictured and described in the folder offered above. It also supplies facts about the PAGE localized engineering and erecting service that assures highest grade workmanship and lasting satisfaction. Page Fence Association members, located in more than 100 cities, are listed in Folder DH-26. See that list for name of member nearest you.

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

REMEMBER . . . *in the dynamic electric power industry, only World* can do World's* work . . .* ***Electrical World** *that is . . .*

CABLE FAULT LOCATOR

WITH REVOLUTIONARY FEATURES

- WILL LOCATE CABLE FAULTS FROM ZERO RESISTANCE TO SEVERAL HUNDRED MEGOHMS WITHOUT CONSOLIDATION
- OPERATES AT LOW VOLTAGE—ONLY 6 VOLTS APPLIED TO CABLE
- ACCURACY 0.1% OF CABLE LENGTH
- SIMPLE, QUICK AND EASILY PORTABLE

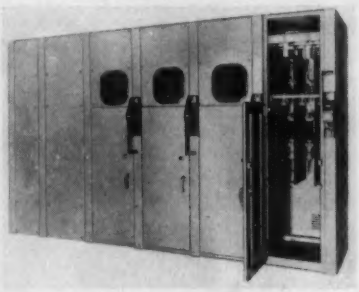
Manufactured Under License from NORTHERN ELECTRIC CO., LTD. by

PATENTS APPLIED FOR

H. TINSLEY & CO., LTD.

234 STE. PAULE AVE., ST. JEROME, P. QUEBEC, CANADA

to steel, 30 oz. per in. width at room temperature; curing cycle, 3 hr at 500F. thickness, 7.3 mils.
Permacel Tape Corp, New Brunswick, N. J.



Power Switching Centers

Industiral power switching centers with two or more interrupter switches, usually fused, are offered for duty at 4.8, 7.2, 13.2, and 14.4 kv, in current ratings of 600 amp with 40,000 amp momentary, and 1,200 amp with 60,000 amp momentary. Switches are in adjacent, free-standing housings and can be connected to one or more 3-phase buses and a ground bus.

They may be used for unit substations, and for loop, radial, and throat or cable connected distribution systems, in addition to continuous process systems with double bus feeders. Arc chute-type load-break interrupters, reportedly good for 500 operations with actual current of 400 amp, can be supplied in many combinations with power or current limiting fuses. Manually operated switches are standard; electrical operation optional. Fast-acting mechanism can be obtained for high speed operation. Interlocks assure proper operating sequence.
R&IE Div, I-T-E Circuit Breaker Co, Greensburg, Pa.

Protective Relay

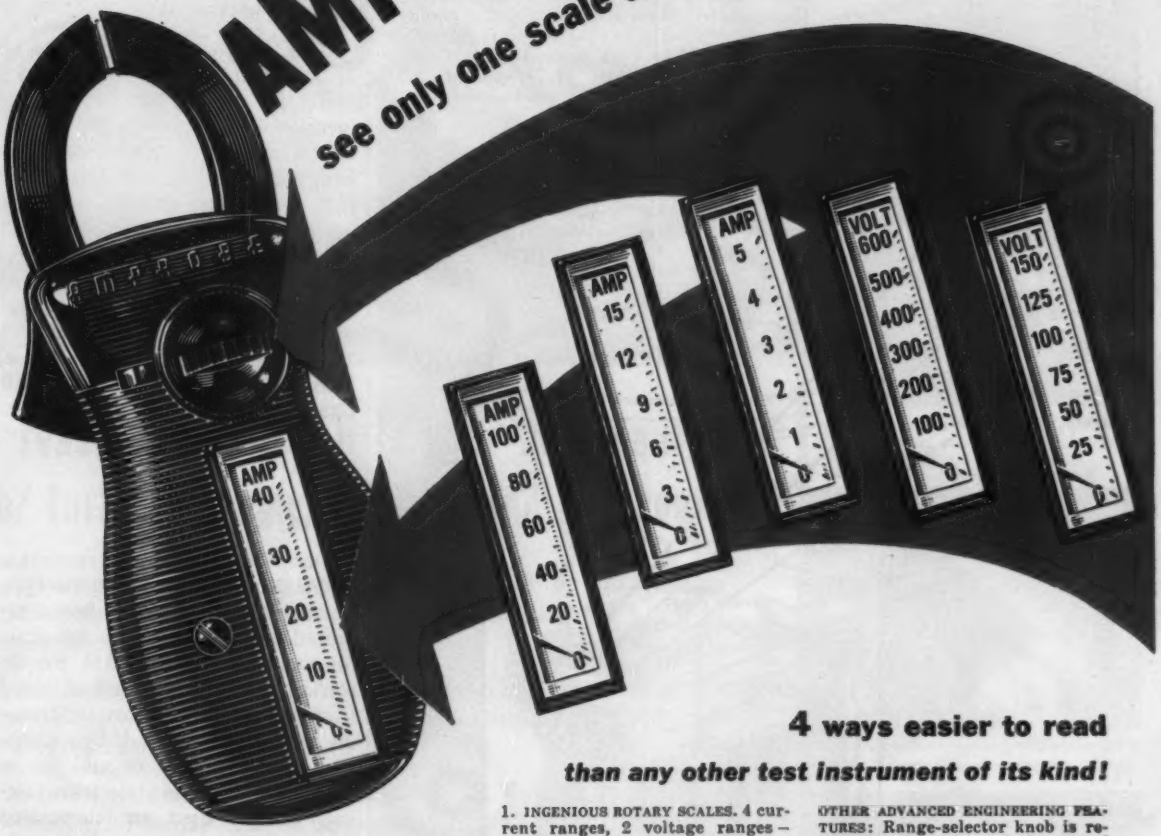
This motor protecting relay, designated Type TS, is said to protect a 3-phase, induction motor against failure due to any combination of shaft overload, voltage unbalance, or single phasing. The relay works on a time current relation and will not drop out in a momen-

(*Continued on page* 114)

More features at your call at the lowest price of all

AMPROBE RS-1 only $39.85

see only one scale at a time!



RS-1 — the volt-ammeter with the most-used ranges

There's one for every job and every budget.

The new RS-1 is one of the 14 AMPROBE models priced from $19.85 to $67.50.

* ®

4 ways easier to read

than any other test instrument of its kind!

1. INGENIOUS ROTARY SCALES. 4 current ranges, 2 voltage ranges — each on a scale of its own!

2. ONE HAND OPERATION! Range selector knob is next to your thumb.

3. NEW MAGNIFIED DIAL . . . LONGER SCALE LENGTH. Greater visibility, greater accuracy, than ever before.

4. POINTER-LOCK "FREEZES" POINTER AT READING. Use the RS-1 any place your hand can reach. Needle can be locked in place so that you may read it away from conductor.

OTHER ADVANCED ENGINEERING FEATURES: Range-selector knob is recessed so that it can't be moved accidentally. Simple bayonet leads lock in at bottom for quick connecting. Impact-proof case with non-slip ribbing. Advance printed circuit construction. Shielded core magnetic movement. Leather carrying case can be worn on your belt.

Amprobe, a division of Pyramid Instrument Corp., Lynbrook, New York, manufacturers of famous REMCON simplified low-voltage Hi-Fashion switching devices.

don't guess at it; AMPROBE IT!

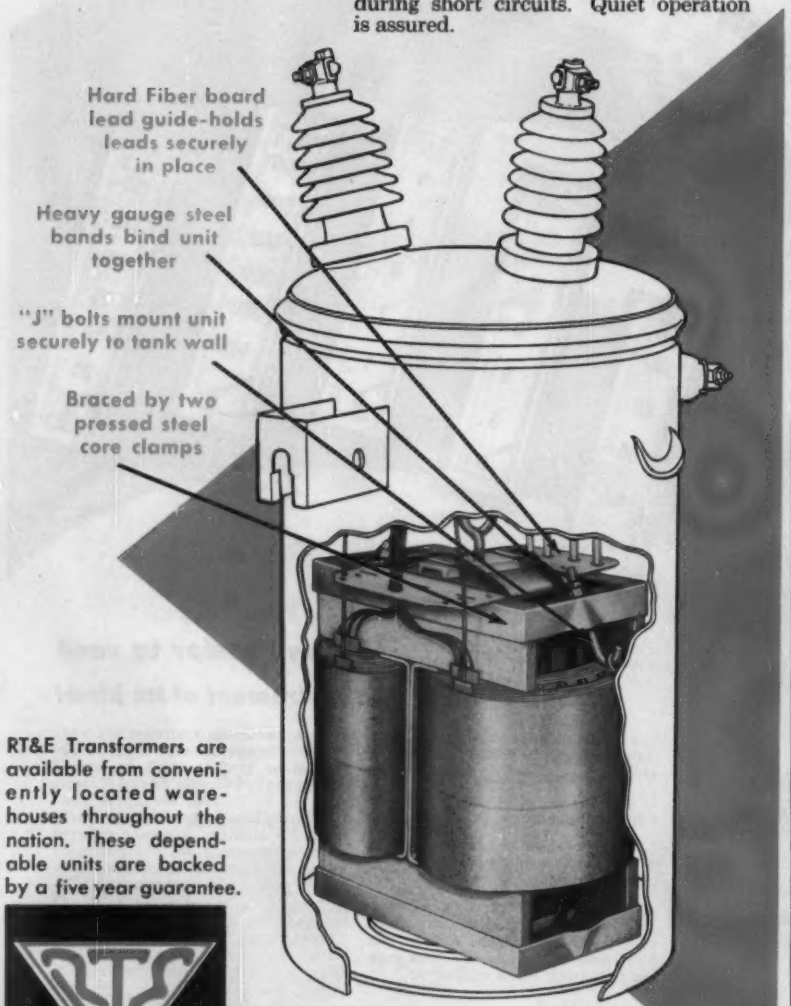
What Makes RT&E Transformers Better?

RUGGED CORE-COIL CONSTRUCTION

Insures longer, more reliable transformer life.

Maximum mechanical strength of Core-Coil unit is obtained by RT&E's unique core-coil clamping method. This eliminates the conventional vertical clamp members by utilizing the tank for this purpose.

A rigid, unitized construction is thereby attained. This maintains all parts firmly fixed with relation to each other—additional coil surface is exposed to the cooling oil, and additional strength is gained for bracing the coil against distortion during short circuits. Quiet operation is assured.


Hard Fiber board lead guide-holds leads securely in place
Heavy gauge steel bands bind unit together
"J" bolts mount unit securely to tank wall
Braced by two pressed steel core clamps

RT&E Transformers are available from conveniently located warehouses throughout the nation. These dependable units are backed by a five year guarantee.

RT&E CORPORATION
WAUKESHA, WISCONSIN

RUGGED CORE-COIL CONSTRUCTION — *Another reason why* RT&E *is better!*

tary loss of one phase.

It is reported to withstand across-the-line starting for periods up to 20 sec where starting current does not exceed six to seven times normal. Manufacturer claims it permits a 10% voltage unbalance at continuous full load but drops the motor at an 8% voltage unbalance if the shaft load reaches 105%. Relay operates on symmetrical components principle.

Electrical Service Co, Ardis Heights, Greenville, Texas

Field Plotter

This improved dry paper type analog field plotter is said to be useful for solving complex two-dimensional field problems involving electrostatic and electromagnetic fields and turbine blade flow patterns. Manufacturer claims it has been used to establish design criteria for electrostatic flow around wires. It is available as a general purpose model and as an educational model. Catalog No. 24 provides additional data.

Sunshine Scientific Instrument, 1810 Grant Ave, Philadelphia 15, Pa.

Wind Recorder

Designed to maximize resolution of fine detail in slow winds, the Type F wind recording system has a reported accuracy of $\pm 4\%$ full scale for wind speed and $\pm 3\%$ for direction. Speed signals are obtained from a precision anemometer; transducer uses high-speed light-chopping principle and is said to be drag-free. Resulting electrical signals can be used on telemetered data collecting systems. Full scale readings are 6, 12, 30, and 60 mph.

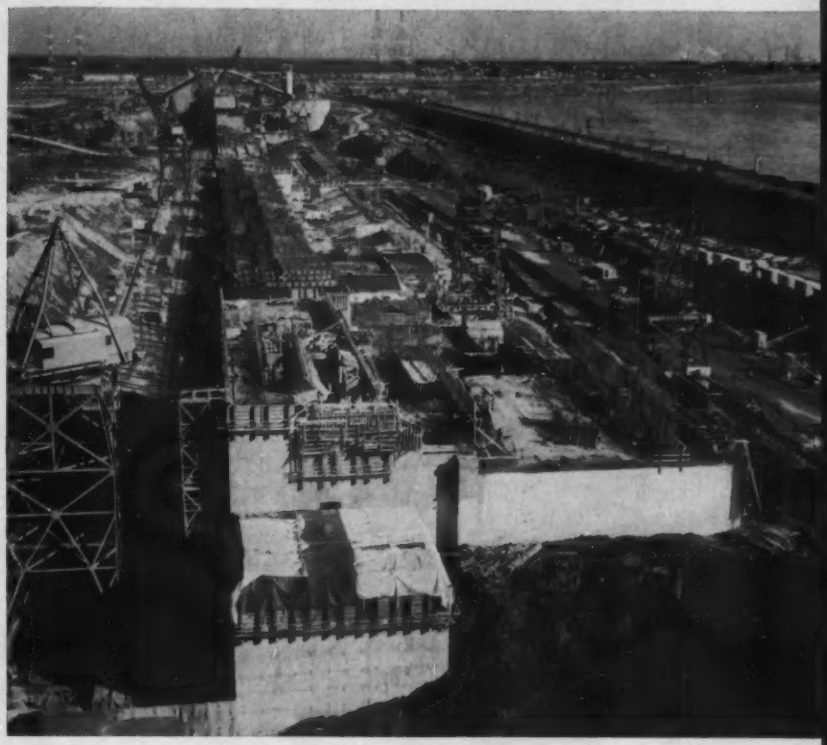
Beckman & Whitley, Inc., 912 E. San Carlos Ave, San Carlos, Cal.

Hydraulic Bender

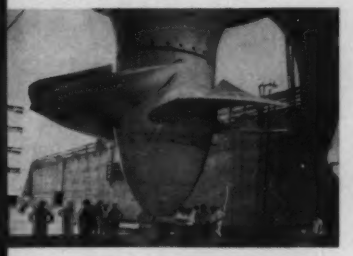
Reported to be able to make a full 90-deg bend in 4-in. pipe or conduit with one ram stroke, this lightweight aluminum alloy hydraulic bender has specially de-

(*Continued on page* 118)

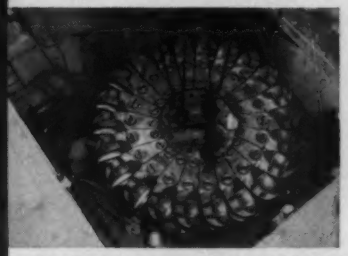
Overall view of the St. Lawrence Power Dam, Barnhart Island, N.Y. Here eight B-L-H fixed blade propeller turbines, each delivering 80,000 hp, will be installed. *Photograph courtesy Power Authority of the State of New York.*



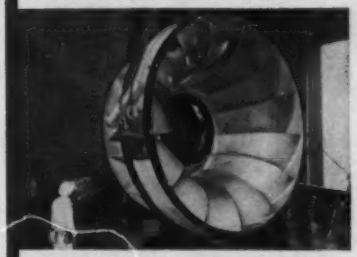
Balancing a fixed blade propeller runner for Wheeler Dam.



Adjustable blade propeller type runner being installed in TVA Fort Loudoun plant.



Impulse turbine runner being installed in the Kemano powerhouse of Aluminium Company of Canada Limited.



Francis turbine runner being unloaded in the Garrison Dam powerhouse.

One of 16 Kaplan turbine governors for The Dalles Dam.

4 reasons why B·L·H is your best source for turbines, pump-turbines and governors

1. Excellent hydraulic laboratories for testing scale models. A large accumulation of test data assures correct design of turbines to meet your specific requirements.
2. The Eddystone and Pelton Divisions of B-L-H have been designing and building turbines since 1841. There is no substitute for 116 years of experience.
3. B-L-H builds all four basic types—impulse, Kaplan, Francis and propeller. You can thus be certain that our recommendations are objective.
4. Governors, surge suppressors, valves, special pumps, and other accessory equipment are also manufactured by B-L-H. When we handle your complete turbine project, you eliminate the necessity of coordinating multiple sources of supply.

For additional information, write B-L-H Corporation, Philadelphia 42, Pa., or Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif.

BALDWIN · LIMA · HAMILTON

Eddystone Division

Philadelphia 42, Pa.

Hydraulic turbines • Weldments • Dump cars • Nonferrous castings

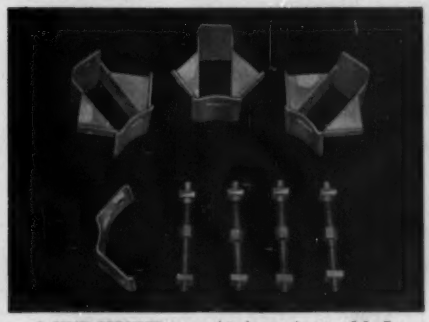
Now one transformer mount

fits all poles 6½ to 16 inches in diameter!

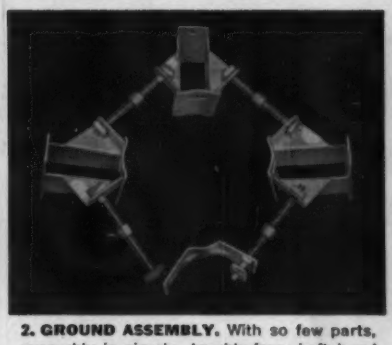
New Hub-Mount* takes all EEI-NEMA Transformers 3 kva to 167 kva in one, two, three combinations

The new Hubbard Hub-Mount brings an entirely new approach to single pole mounting of distribution transformers. It saves you money by eliminating platform construction with its carpentry and maintenance costs. If you are now using single pole mounting equipment, Hub-Mount will cut your inventory because one item fits all the poles normally used in this type of application. Your installation costs will be reduced because the Hub-Mount can be quickly installed by one man, and it is completely salvagable. For the complete Hub-Mount story write for a copy of bulletin P-357.

Working scale model demonstrates ease of assembly!

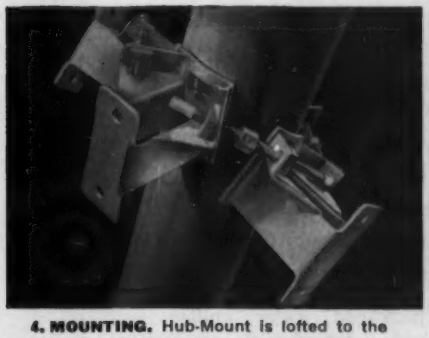


1. HUB-MOUNT assembly is made up of 1, 2 or 3 mounting boxes and quarter plates plus 4 turnbuckle-type bolts. Connecting bolts are fabricated from Cor-Ten steel for long service life. In tests, Hub-Mount has supported more than three times the weight of three 167 kva transformers without any visible deformation!



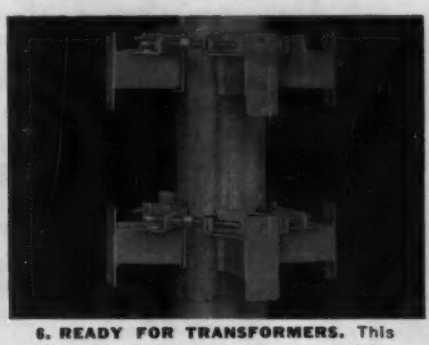
2. GROUND ASSEMBLY. With so few parts, assembly is simple, trouble-free. Left hand bolt threads and nuts are color-coded to speed assembly by eliminating trial and error. Hub-Mount's all steel design eliminates carpentry, periodic maintenance present in platform construction.

3. GROUND ADJUSTMENT. Turning downward on hex section of turnbuckle bolts adjusts size of Hub-Mount to pole diameter at the point of installation. Hub-Mount has only four points of adjustment. By adjusting three of them on the ground, it is only necessary for the lineman to wrench at one point on the pole.

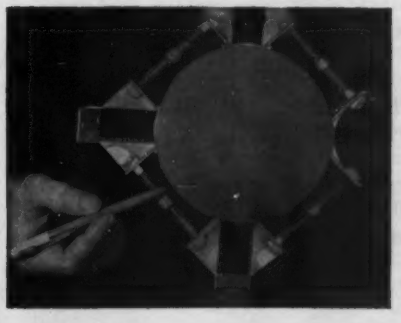


4. MOUNTING. Hub-Mount is lofted to the pole, hung from one lag screw driven into the pole at the desired height. This leaves the lineman entirely free to complete the installation, by connecting open turnbuckle bolt to quarter plate. Lineman makes his installation from one point on the pole!

5. FINAL ADJUSTMENT. Wrenching downward on the hex section completes installation. When installed, Hub-Mounts work in compression, are not loosened by pole shrinkage. The weight of the transformers causes the Hub-Mount to bind on the pole, thereby maintaining a tight grip.



6. READY FOR TRANSFORMERS. This simple, flexible arrangement accommodates all EEI-NEMA transformers from 3 kva to 167 kva in combinations of one, two or three. Hub-Mount's exclusive design places no reliance on welds, which work in compression, do not govern available strength.



7. WRENCH CLEARANCE. Note wrench clearance at maximum adjustment on 16 inch pole diameter.

*Patent Pending

HUBBARD AND COMPANY

Pittsburgh 1, Pa.
Chicago, Ill.
Oakland, Calif.
Plano (Dallas), Texas

Self-aligning, identical die halves lock rigidly into place, are held securely seated by spring locking pins—yet are easily snapped in and out with fingers.

KEARNEY
0-51 and 0-52 TOOLS

...install widest range of compression sleeves and fittings

Greater economy, speed, convenience in installing compression connectors—and widest range of fitting sizes.

Lightweight, rugged, simple to operate.

Safe for use on energized circuits at distribution voltages.

Versatile, low cost... you can have one of these Kearney tools on every line truck.

Make connections through these line wire sizes with 0-51 and 0-52 Tools:

SQUEEZONS, 4/0 ACSR, or stranded aluminum
L-TAPS—2 ACSR, stranded aluminum or copper
T-TAPS—1/0 ACSR, stranded aluminum or copper
SERV-ENS—1/0 ACSR, 4/0 stranded aluminum or copper
SLEEVES—4/0 stranded aluminum, 2/0 ACSR and stranded copper

373

JAMES R. KEARNEY CORPORATION • General Offices: 4224-42 Clayton Ave., St. Louis 10, Mo.

for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify **KEARNEY PRODUCTS**

Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IA. GUELPH, ONT., CAN.

signed pipe supports which serve as rollers in moving the equipment from one place to another. Used with the appropriate power pump, it reportedly can bend the 4-in. pipe in 30 sec. Attachments are available for bending thin-wall conduit, tubing, and bus-bar. Quick-change, positive-locking pipe support pins are said to permit quick, easy removal of pipe without disassembling bender. Bulletin Form E-224 has complete data.
Greenlee Tool Co, Rockford, Ill.

Circuit Breakers

Said to eliminate any possibility of single-phasing, Tri-Pac circuit breakers contain a modified AB breaker and a current-limiting fuse with time delay-thermal, instantaneous magnetic, and current limiting-fusible tripping elements. Plungers in the special fuses indicate which phase or phases are in trouble, thus eliminating fuse testing. When breaker is reset, tripping cause, whether overload, usual fault, or extreme fault, is indicated. Manufacturer claims breakers can be easily reset after breaking on overload or usual fault current.

Breakers are available in three frames for 100, 225, or 400 amp, for two or three poles. Interrupting capacity is reported to be 100,000 amp at 250 v dc and 600 v ac.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Water Chiller

Available in 3 and 5-hp sizes, this packaged water chiller requires only 8.3 ft of floor space, and needs no refrigeration piping. The factory assembled unit has an automatic on-off switch, a magnetic starter that controls compressor operation, a thermometer to maintain desired water temperature, and a freeze-up thermostat, factory set at 38 F, to prevent water from freezing in the chiller.

The hermetic compressor is a horizontal shaft type, equipped with a suction gas-cooled motor which operates on 3-phase, 60-cps 208/220 v or 1-phase, 60 cps, 230 v.
Worthington Corp, Harrison, N. J.

Refreshment Machines

Six models of a refreshment machine series include both hot and cold water taps and are available as either bottle or pressure types. One model features a small, executive-type refrigerated compartment. These equipments are said to be useful for dispensing packaged servings of coffee, cocoa, tea, and soup.
General Electric Co, Bloomfield, N. J.

Circuit Breakers

Enclosed, molded case, air circuit breakers are offered in NEMA IV, VII, and IX enclosures for fault protection up to 100,000 amp. The units combine a current limiting fuse and breaker in one case. Low magnitude fault currents are cleared through the breaker without affecting the fuse. At higher magnitudes, the fuse is said to assume fault-clearing in less than 0.5 cycle and limit the short circuit current to fraction of peak available value.
Hope Electrical Products Co, Inc, 32 Long Ave, Hillside, N. J.

Insulation Tester

Intended for continuous production use in manufacture of insulated wire, the P-3 insulation tester combines a tester with a fault indicator and counter and can be used to detect either pinholes or substandard insulation. The unit has two separately variable power supplies and energizes one electrode at 100 v, the second as high as 20,000 v.
Peschel Electronics Inc, 15 Garden St, New Rochelle, N. Y.

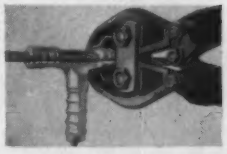
Tool Pickup

This positive grip pickup is designed for recovering tools or rods lost in conduit. It can also be used on long pulls where it is expedient to work from both ends. Two steel shutters with beveled notches and spring action are said to catch tool and hold it firmly regardless of its position in the conduit. Outside diameter is 3 in.
T. J. Cope, Inc, Third & Walnut St, Collegeville, Pa.

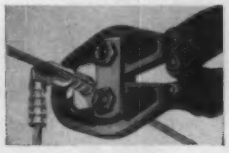
KEARNEY
0-51 and 0-52 TOOLS

Self-aligning, identical die halves lock rigidly into place, are held securely seated by spring locking pins—yet are easily snapped in and out with fingers.

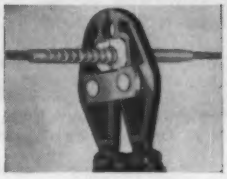
SERV-ENS



T-TAPS



L-TAPS



SLEEVES

...“snap in-snap out” insert dies save crew time on installations

Fixed die conveniently positioned in jaw nose installs Serv-Ens and L-Taps.

Insert dies are available to install sleeves and Squeezon fittings for most wire sizes used on distribution systems.

Wire cutter dies, also available, snap into same seat as the interchangeable dies for compression fittings.

Heavy gauge steel carrying case—recommended for storing Type O Tools and dies. Tray takes full set of dies.

374

JAMES R. KEARNEY CORPORATION • General Offices: 4224-42 Clayton Ave., St. Louis 10, Mo.

for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify KEARNEY PRODUCTS

Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IA. — GUELPH, ONT., CAN.

PORTABLE PHASE ANGLE METER

Completely self-contained, and requiring no auxiliary equipment for its operation, this Portable Phase Angle Meter offers a direct way of checking relay and instrument connections, particularly directional over-current relays, differential relays or similar equipment. It may also be used to measure the prevailing power factor in each phase of a polyphase watthour meter installation. The device has a frequency of 60 cycle, with voltage ranges of 60, 120 and 240 volt. Current ranges are 1, 2.5 and 5 amp. . . . DIMENSIONS: 9½ x 6¾ x 5⅝ in. Weight 19 lbs.

Also available in other voltage combinations

Write for Bulletin #75 for complete information

EASTERN SPECIALTY CO.

PHILADELPHIA 40, PA.

CATALOGS—BULLETINS

• **MISCELLANEOUS:** The following publications have been issued recently by General Electric Co. The address is Schenectady 5, N. Y., unless otherwise indicated:

Current limiting fuses capable of interrupting short circuit currents up to 200,000 RMS symmetrical amp are covered in GEA-6319B.

High speed, multi-stage turbines to drive boiler feed pumps are described in GEA-6541.

"Channel Guard" radio squelch device is the subject of ECR-449, published by Electronics Park, Syracuse, N. Y.

Resistors, the complete line of vitreous enameled ones, are detailed in GEA-6592.

Precision Hoist, bridge & trolley control systems are covered in GEA 6434.

Non-synchronous control for resistance welding is the subject of GEA-6593 and GEA-6108.

GE's Magnetic Magnet Materials Laboratory and its functions are described in a publication released by Magnetic Materials Section of the Metallurgical Products Dept, Edmore, Mich.

New Instrument Transformer 1957 Buyer's Guide, GEC-1028B, is now available.

Dry-type specialty transformers for general light and power service are covered in GEC-1431.

Mercury lamp transformers and reactors are the subject of GEC-1440.

• **ANODES:** A revised general catalog covering its Duriron and Durichlor Impressed Current Anodes for cathodic protection has been issued by Duriron Co, Inc, Dayton, Ohio. Ask for general bulletin DA/lb.

• **ELECTRIC THERMOSTAT:** A bulletin describing its Model H1 electric thermostat for over-temperature protection of steam generating systems and other commercial, laboratory and industrial equipment is available by writing to Robertshaw-Fulton Controls Co, 110 E. Otterman St, Greensburg, Pa.

• **CONTACT METER-RELAYS:** Catalog No. 4-C covers contact meter-relays for indication and control of any physical and chemical process that can be detected electrically. It has been published by Assembly Products, Inc, Chesterland, Ohio.

• **CONSTANT VOLTAGE TRANSFORMERS:** Circular CV-260 describes 10 new constant voltage transformers made by Sola Electric Co, 4633 W. 16th Street, Chicago 50, Ill.

• **MAGNETIC CLUTCH:** "The World's Finest Magnetic Clutch" is the name of a six-page bulletin describing the Fawick Magnetic Clutch made by Fawick Corp, 9919 Clinton Road, Cleveland 11, Ohio.

• **MISCELLANEOUS:** The following publications have been published issued recently by Automatic Switch Co, Florham Park, N. J.:

Automatic Transfer Switches are covered in Catalog 57-S1.

Remote Control Switches are the subject of Catalog 57-S2.

Contractors are described in Catalog 57-S3.

Relays for circuit or load control are covered in Catla Catalog 57-S4.

Solenoids for a variety of standard and special applications are detailed in Catalog 57-S5.

Electric Plant Controls for standby electric plants are the subject of Catalog 57-S6.

• **WEATHER-PROTECTED MOTORS:** Features which reportedly contribute to the outdoor dependability of A-C weather-protected motors (Type FOD) in ratings from 250 to 900 hp are described in a bulletin issued by the company. Request Bulletin 51B8606A from Allis-Chalmers Mfg Co, P. O. Box 512, Milwaukee, Wis.

• **WORM GEAR DRIVES:** A 16-page brochure, entitled "Fingertip Facts on Cleveland Worm Gear Drives", provides summary information on the complete line of speed reducers, worm gear sets and special units manufactured by Cleveland Worm & Gear Co, 3249 E. 80th Street, Cleveland 4, Ohio.

• **OUTDOOR LIGHTING:** Bulletin No. 56078, "Outdoor Lighting—Industrial and Commercial Applications," explains the uses of fluorescent, incandescent, and mercury vapor equipment for lighting outdoor commercial facilities or areas. Available from Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.

TECHNICAL LITERATURE

MISCELLANEOUS—A handbook of miscellaneous electrical information, beginning with basic definitions and continuing through generators, wiring, cables, conduit, etc., has been published by Chase-Shawmut Co. The book, entitled, "The Chase-Shawmut Book of Electrical Information," also contains several chapters on the company's "Amp-Trap." Pocket-size, 160 pages. Address Chase-Shawmut Co., Newburyport, Mass.

HIGHWAY LIGHTING—A 12-page booklet, "Highway Lighting", has been prepared for those involved in the design and engineering of highways and streets. The emphasis is on night safety. Ask for Technical Bulletin No. 222, 1957, from American Road Builder's Assn, World Center Building, Washington 6, D. C.

ALUMINUM BUS CONDUCTOR—A 280-page, hard cover handbook entitled, "Alcoa Aluminum Bus Conductor Handbook," has recently come off the presses. The book presents facts and figures important to anyone responsible for the engineering and maintenance of bus installations. It contains 69 graphs, tables and photographs. Introductory material traces the development of aluminum's use and its properties as a conductor. Subsequent chapters deal with conductor shapes, design, reactance, capacities, deflections, joints and short-circuit conditions, while final chapters explain fundamentals of installations. There is also a fairly comprehensive bibliography. Copies may be obtained by writing on company letterhead to Aluminum Co of America, 793 Alcoa Building, Pittsburgh 19, Pa.

"I'll never replace VICTOR SUSPENSIONS... I just won't live that long!"

Men who purchase insulators are enthusiastic about the service records of VICTOR Suspensions. That's because VICTOR Suspensions are laboratory designed, manufactured under rigid quality controls and tested with the industry's most modern equipment.

Take the No. 900 Insulator shown above, for example. It has rugged, rounded corrugations for maximum strength and resistance to impact. Cap and ball bolt are thick, husky and galvanized to withstand severe service. Scientifically fitted glaze gives added strength and added protection against contamination.

Each insulator is proof-tested mechanically, then subjected to vigorous high frequency and 60-cycle flashover tests. When you buy VICTOR, you just can't buy better suspensions!

New . . . . . .

VICTOR CATALOG

Now ready for distribution is Victor's newest and most extensive catalog. One of the most complete in the field, it includes illustrations and data on many items being produced at VICTOR and not previously shown, up-to-date EEI-NEMA Standards, and an outline of VICTOR'S new plant, research, testing and manufacturing facilities. It's FREE! Write for *your* copy.

VICTOR INSULATORS DIVISION

I-T-E CIRCUIT BREAKER CO., INC.
VICTOR, N. Y.

5-10 TC @ 6 IN.	35 X 72

COOLING DATA-	OA	FA	WEIGHTS-
RISE GUARN.	55		CORE AND COI
GRADIENT	7.972		LBS LIQUID
AVG. OIL	44.02		WALLS/BRACES
CONV. COEF.	.1450		COVER/BOTTOM
RADN. COEF.	.2164		TUBES
TUBES/RAD COEF.	.1408		FANS/EQUIP.
CONV. WATTS	3477.694		RADS.
RADN. WATTS	8786.892		FANS/EQUIP.
TEMP. RUN WATTS	33402.84		BASE
DISSIPATED WATTS-			EXP. TANK
NEEDED TUBES/RADS.	21138.26		CASE AND FTG
ACTUAL TUBES/RADS.	21260.96		TOTAL TRANS.

FANS-	FOR RADS.	FOR TUBES	LIQUID- GALS.
ON BACK			TOTAL GALS.
ON EACH END			TRANS. TANK
ON FRONT			EXP. TANK

KVA 3750 H.V. 22900 DELTA L.V. 4160 W

IBM 705 CONSOLE

Helping the industry meet its growing loads

This machine advances tomorrow's developments

Time is of the essence to solve the intricate design and application problems consuming enormous amounts of engineers' time.

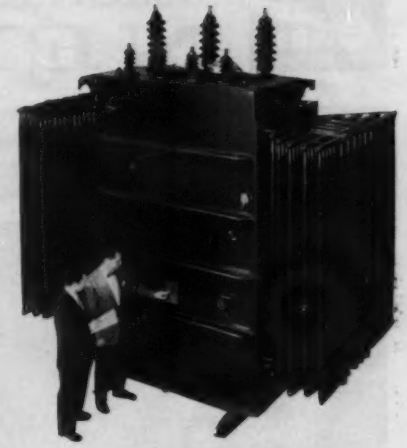
For this reason, Westinghouse has invested heavily in the design of power transformers by electronic computers. This automated designing is freeing dozens of engineers from millions upon millions of mechanical computations. As a result, Westinghouse creative design capacity and long-range development are greatly expanded. The result . . . creative engineering progress.

Look for new materials and years-ahead methods of construction from Westinghouse. This, combined with new ideas, will produce better products which can be translated into money savings for you. From pioneering ideas at Westinghouse, look for equipment that will help you keep the cost of electricity the consumer's biggest bargain.

J-97202

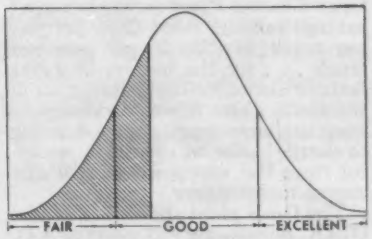
YOU CAN BE SURE...IF IT'S

Westinghouse



Designed with electronic computers

In addition to rating, complete performance data was loaded into the machine—impedance, iron loss, total loss, exciting current, temperature rise, sound level and many other variables. The computer made the necessary calculations of physical quantities and proportions of iron, copper and insulation. Tank dimensions, cooling requirements and other factors were all calculated to bring the design to optimum standards. Human error was eliminated.



Distribution of design quality . . . shaded area is eliminated in computer design

Electronic computers have reduced transformer design time from two weeks to four minutes. Coupled with this is the machine's unusual genius of being able to produce optimum designs consistently . . . equal to designs of top engineers with unlimited time.

Onan ELECTRIC PLANTS

ELECTRIC PLANT NEWS

Onan ELECTRIC PLANTS

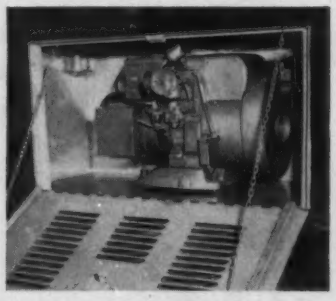
Truck-mounted electric plant cuts costs two ways

Onan Plant provides A.C. power for electric tools and lights, and D.C. output to charge batteries for radio communication.

Utilities using this dual-purpose Onan Electric Plant on trucks report savings ranging from *$2.00 per day* per truck to *$800.00 per year* per truck . . . for the battery-charging feature alone. Before installation of the Onan plant it was necessary to keep the large truck engine running to charge batteries, extremely wasteful from the viewpoint of fuel and engine maintenance.

The Onan plant shown is a Model O7AK, developing 750 watts of A.C. with about 8 amperes for 12-volt battery charging. It is powered by an Onan single-cylinder, air-cooled gasoline engine direct-connected to an Onan all-climate generator in a compact, rigid, long-life unit. A.C. output is sufficient for operation of drills, saws and other tools used for construction and maintenance.

Other vehicular battery charging plants and A.C. models available.



Vacu-Flo cooling system permits enclosed installation

With Onan's Vacu-Flo system, air is drawn (rather than blown) through generator and engine, and discharged through a duct to the outside. An Onan air-cooled plant with Vacu-Flo can be installed in a small compartment within truck or trailer.

Ask your Onan distributor about this dual-purpose unit or write for circular on three battery charging methods.

D. W. ONAN & SONS INC.

2979 University Ave. S. E., Minneapolis 14, Minnesota

Onan ELECTRIC PLANTS

ELECTRIC PLANTS • AIR-COOLED ENGINES • GENERATORS • KAB KOOLER

BOOKS

How To Invent

Inventors and Inventions. **By C. D. Tuska. Published by McGraw-Hill Book Co., 330 West 42nd Street, New York 36, N. Y. 174 pages, illustrated. Price $3.75.**

This little book is both instructive and entertaining. It is instructive because it will stimulate inventive tendencies, further them with a knowledge of the psychology and method of invention, and foster effective protection for inventions. It is entertaining because of the means used to accomplish these ends.

The book is writen in a light colorful style. The author knows his subject matter and uses, "case histories" to establish his points. He begins by presenting numerous statistics about inventors and their environment—for instance, the most productive age for inventors is about 35; people living in Delaware, New Jersey and Connecticut appear to be the most inventive.

Experiment, serendipity, synthesis, imagination and foresight are factors cited by the author as methods of invention. Case histories are used to exemplify these methods.

For the person who has inventive tendencies this book is a "must"; for all others it would at the very least provide an evening of entertaining, informative reading.

Electronics for the Beginner

Basic Electronics. **By Paul B. Zbar and Sid Schildkraut. Published by McGraw-Hill Book Co, 330 West 42nd Street, New York 36, N. Y. 91 pages, illustrated. Price $1.75**

Basic Radio and Receiver Servicing. **By Paul B. Zbar and Sid Schildkraut. Published by McGraw-Hill Book Co, 330 West 42nd Street, New York 36, N. Y. 105 pages, ill. Price $2.00.**

These two laboratory manuals were prepared by the teaching staff of the Radio, Electronics and Television Manufacturers Association as pre-employment courses for beginners in vocational, trade, and technical schools. They are intended to provide the user with a practical knowledge of radio and electronic fundamentals as a basis on-the-job training.

Basic Electronics includes experiments both on fundamental vacuum tube characteristics and on applications such as oscillators, detectors, amplifiers, and power supplies.

Basic Radio and Receiver Servicing contains troubleshooting and repair techniques for all types of receivers: superheterodyne, ac-dc, auto, FM, portable, and printed circuit.

These concise, well organized manuals should be valuable both for training new utility communications personnel and for those with personal interests in amateur radio.

ELECTRICAL BUSINESS OUTLOOK

Electrical World
MAY 27, 1957

December peak load estimates for 1957, 1958, 1959 are trimmed slightly in latest Edison Electric Institute Power survey. Reporting companies now expect a 113.4-million kw peak in December of this year and 15.5% margin of capability over peak.

Six months ago, 115-million kw peak and slimmer margin were anticipated. Estimates for year-end peaks next year and 1959 are just a few thousand kw less than was expected at the time of the last survey. Margins are proportionately greater.

• • •

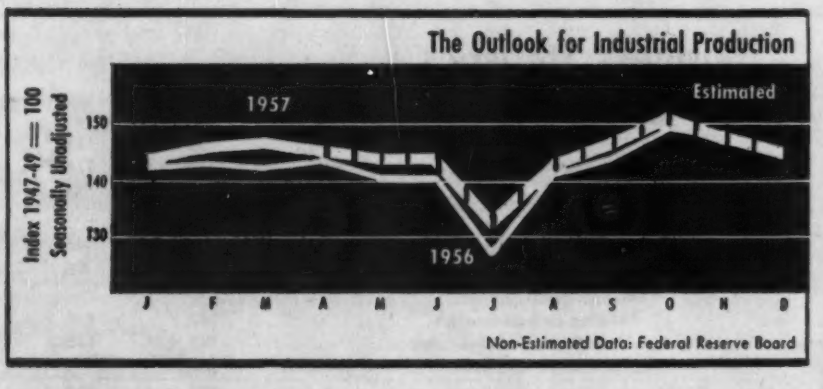
Value of new construction—other than housing—continues to climb. Commerce Department statistics show $12.5 billion has been spent on new construction this year. This 2% gain over the same period in 1956 comes from expanded commercial and industrial construction and government works project. Price increases account for about all the year-to-year gain in dollar volume, though.

But the rise in the cost of building is slowing down. McGraw-Hill's Engineering News-Record's index of construction costs shows less than a 1% increase in over-all costs of labor and materials between last September and April. Prices of some building materials, particularly steel, will probably resume their upward course later this year.

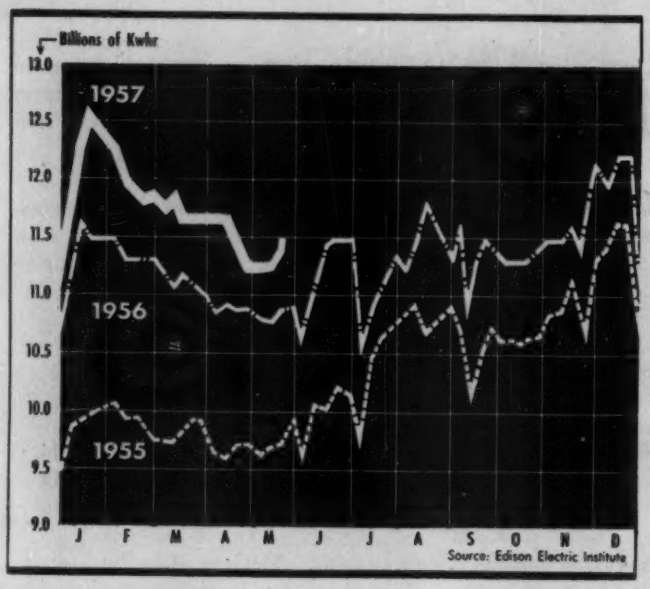
Housing starts will run around 950,000 this year—the lowest since 1948. Number of starts picked up some in April. But the gain wasn't enough to suggest any brighter year-end tally. April starts were at rate of 940,000 (seasonally adjusted). This looks good compared with March rate of 880,000, but doesn't approach the 1.1 million rate reported in April last year.

• • •

Housing lag is one factor in the decline of appliance sales for the first quarter. Electric range sales dropped 12.1%; refrigerators decreased 11.2%; and dishwashers, 6.2%, the National Electrical Manufacturers Association reports. Home laundry equipment sales are down about 20%. Main reason, though, appears to be burden of instalment debt that has both appliance dealers and utility credit managers worried (EW, May 13, p 76).



STATISTICS



OUTPUT

Week ended May 18,
11,519,000,000 Kwhr
Up 5.9%

Per Cent Change From Previous Year

	May 4	May 11	May 18
Total U. S.	+4.4	+ 4.4	+5.9
New Eng.	+1.7	+ 4.2	+4.2
Mid. Atlan.	+3.0	+ 3.4	+5.0
Cent. Ind.	+1.8	+ 2.0	+4.4
West Cent.	+3.3	+ 5.1	+7.2
Southeast	+6.8	+ 7.7	+8.2
South Cent.	+6.2	— 3.1	+4.3
Rocky Mount.	+3.1	+ 3.1	+2.6
Pacific			
NW	+5.1	+ 5.2	+6.7
SW	+9.2	+12.4	+9.4

Seasonally Adjusted Index 228.1
Week Ago 224.7
Year Ago 215.6

Atomic Energy Commission requirements—1,150,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 6.3%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity, Peak—Class 1 Systems, Estimated Dec. '57 Peak (million kw)	Mar.	121.78	121.33	116.56	4.5
	Feb.	98.8	103.8	94.2	4.9
	Mar.	113.5	113.5	114.1	— 0.5
Production—billion kwhr	Mar.	52.45	48.67	50.34	4.2
Hydro		11.44	9.98	11.78	— 2.9
Fuel		41.01	38.69	38.56	6.4
Sales—billion kwhr	Feb.	47.78	49.15	45.41	5.2
Residential		14.25	14.44	13.06	9.1
Commercial		7.49	7.54	6.91	8.4
Industrial		23.65	24.68	23.20	1.9
Other		2.40	2.49	2.24	7.1
Fuel Consumption	Mar.				
Coal—million tons		13.84	13.21	13.39	3.4
Oil—million barrels		6.57	6.96	6.22	5.6
Gas—billion cu ft		93.15	83.24	85.17	9.4
Net Income Class A & B Co's—$ million	Mar.	126.81	142.34	116.86	8.5
Residential Customers—millions	12 mos.	45.92	45.81	44.59	3.0
Revenue per kwhr	ended	2.59¢	2.59¢	2.63¢	— 1.5
Avg. kwhr per customer	Feb. 28	3,004	2,985	2,800	7.3
Avg annual bill		$77.80	$77.31	$73.64	5.6

Business Statistics . . .

Indexes: 1947—49 = 100					
FRB Industrial Production	April	146	148	144	1.4
ENR Construction Cost	May	150.0	148.7	144.3	4.0
BLS Cost-of-living	Mar.	118.9	118.7	114.7	3.7
New Orders for Machinery (1950 = 100)	Mar.	161	156	161	n.c.
NEMA Sales					
Insulation materials	Mar.	153	146	168	— 8.9
Electric appliances		97	94	120	—19.8
Wholesale prices	Mar.				
Motors and generators		140.7	140.2	126.9	10.9
Transformers and regulators		147.4	146.6	133.1	10.7
Switchgear and fuses		164.4	164.4	147.8	11.2
GNP—annual rate—$ billion	1st Qtr.	427.0	423.8	403.4	5.9%

MANAGEMENT BULLETIN

FINANCE

New security offerings of electric utilities were heavy again last week. "Bonds are going well" was the comment by First Boston Corp group as it began offering $30 million Public Service Co of Colorado first mtg 4⅜% bonds (Aa) due 1987 at 100% to yield 4.375%. Bonds had been won earlier by the group with a bid of 99.31% . . . Kidder, Peabody & Co and associates are offering 680,000 common shares Interstate Power Co at $13.75 a share . . . Harriman Ripley & Co group is offering 200,000 shares Niagara Mohawk Power Corp $100 par 5¼% preferred stock at $100 a share to yield 5.25% . . . Public Service Co of New Mexico is offering 166,997 common shares to its stockholders on 1-for-10 basis, record May 20 to expire June 12 at $13.50 a share. Another 15,000 shares is being offered employees at the same price. Allen & Co is heading the underwriting group on this utility issue.

Is a trend developing on non-callable clauses in the sale of new bonds? Recently New York State Electric & Gas Corp altered its terms on the $25 million bond issue to make it non-callable for five years.

Some of the new security issues offered recently by electric companies have been successful. Florida Power & Light Co's $15 million bond issue was "fully subscribed." El Paso Electric Co's $5.40 preferred stock issue of 20,000 shares was "oversubscribed."

"The Importance of Growth Trends" is the subject of the latest bulletin issued by Josephthal & Co. It gives an index of growth for 93 electric operating and holding companies. It shows the average earnings of these companies was $2.22 in 1956 as compared with $1.73 in 1950. For copy, write Trus Hyde, Josephthal & Co, 120 Broadway, New York 5, N. Y.

Approves $10 million bond issue. Shareholders of the Salt River Water Users Assn has okayed this bond issue to finance completion of a second 100,000-kw unit at its New Agua Fria plant. Sale of the bonds will be started soon.

Two more companies have announced common stock sales. Philadelphia Electric Co will offer 609,815 shares to common stockholders on a 1-for-20 basis, record June 4 to expire June 25 . . . Central Vermont Public Service Co will sell 125,000 common shares. It plans to offer the stock through an underwriting group headed by Hallgarten & Co.

RATES

Arkansas Power & Light Co gets $1.8 million a year rate increase. New schedules will up residential rates by an estimated $600,000 a year, or about 20¢ a month for the average customer. Commercial and industrial rates will be increased about $1.2 million a year.

California Electric Power Co seeks 9.6% rate hike. In its petition to the PUC the company said that this increase would raise the average bill of Calectric's domestic customers by only 33¢ per month.

Higher rates for Painesville, Ohio. City Council has just heard a second reading on an ordinance for the city to increase rates by about $96,000 a year.

Casco Bay Light & Power Co, Portland, Me., has asked the Maine Public Utilities Commission for a 23% rate hike. This is the first such increase since 1924.

Higher rates in London, England scheduled for May 31. London Electricity Board will up rates about 10% because of higher fuel and wage costs and increased charges for electric power purchased from the British Central Electricity Authority.

Three factors led Arkansas-Missouri Power Co to file new schedules to reduce rates by $38,185 a year. They are: Improved economic conditions in the area,

increased earnings and the fact that the company is "constantly striving to improve its over-all operating efficiency in spite of a general trend in prices."

ACQUISITION

Virginia Electric & Power Co will take over Roanoke Utilities. Company has received North Carolina Public Utilities Commission approval to purchase this company for $200,000. Commission estimated that Roanoke Utilities' customers, through application of Vepco's rates, would realize an annual overall saving of from $15,000 to $20,000 on present kwhr consumption.

EMPLOYEE RELATIONS

Portland General Electric Co and IBEW have agreed to a 4½% wage increase. Agreement includes provisions for a four-week annual vacation for employees with 20 years company service. This was an extension of the three-week vacation granted employees with ten years service under the expired contract.

PUD's competing with private utilities have the implied power to make job benefit contracts similar to those offered by their competitors, Attorney General John J. O'Connell of Washington State ruled recently in an opinion concerning the Grant County PUD. Opinion permits PUDs to provide retirement benefits for employees through group insurance from a private company.

FRANCHISE ELECTION

Manteo, Va., citizens vote 179 to 58 in favor of giving Virginia Electric & Power Co a 30-year franchise rather than have the town operate its own power utilities.

LEGISLATION

Coal carrying pipeline question raised in North Carolina. Duke Power Co and Carolina Power & Light Co officials ask Senate Public Utilities Committee to approve bills which would give them power to condemn land for construction of coal carrying pipelines. W. B. McGuire, assistant to the president of Duke Power, told the committee that his company has no present plans for building such a pipeline but "it may be well that before the legislature meets two years from now we will have such plans." He said Duke Power believes coal pipelines have "real possibilities" for reducing railroad freight costs for power companies.

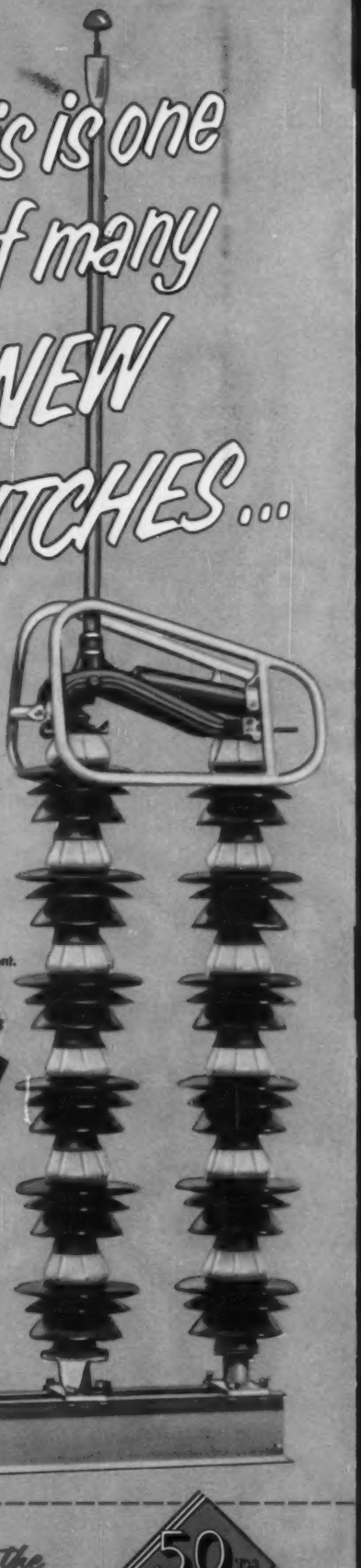
A bill which would make "net prudent investment" the basis for valuing the property of public utilities for rate-making purposes has been passed by the Maine House. The bill would have the effect of deleting "current value" of property as a factor in determining a rate base. Central Maine Power Co has won court backing for its contention that the PUC did not give sufficient weight, in handling rate increase petitions, to "current value," which is one of several factors that must be weighed under existing Maine law.

Texas legislature passes bill on rural area issue. Bill will permit rural electric co-op service to be provided at or to (1) Structure or point of delivery in rural area not receiving central service, although owners may receive utility company power at other points in either rural or non-rural areas; (2) Any structure or point of delivery in a formerly rural area annexed by a city previously served by an rural co-op plus other structures in an annexed area to which utility company service is not available; (3) All persons in a city or town an REA is now serving if no utility company service was available when the co-op began serving it, and (4) All persons in rural areas who are not receiving utility company service.

PUBLIC RELATIONS

Two companies cited by the United Shareholders of America. Middle South Utilities, Inc, and Virginia Electric & Power Co have received citations for meritorious achievement in the field of management-shareholder relations. Citations were presented for "encouraging participation in American corporate ownership."

"This is one of many NEW SWITCHES..."



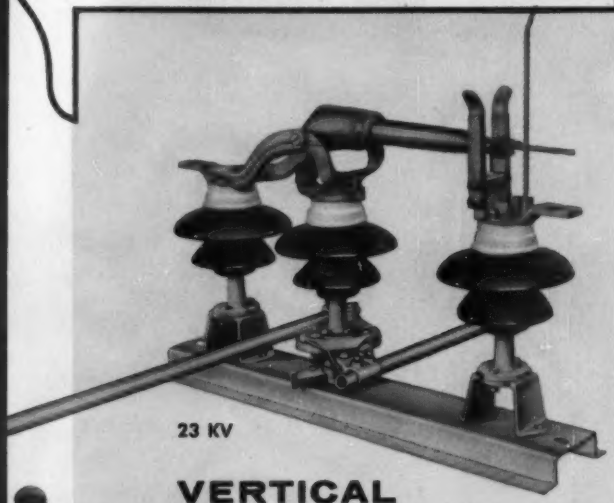
...you'll see in this ad on our completely modernized line... all designed to meet today's increasingly complex systems."

C. A. "Chuck" Liming,
A. B. Chance Company,
Sales Manager,
Power Switching Equipment.

Serving the Utility Industries since 1907

50TH ANNIVERSARY
A. B. CHANCE COMPANY

ENGINEERED to give you better system operation



23 KV

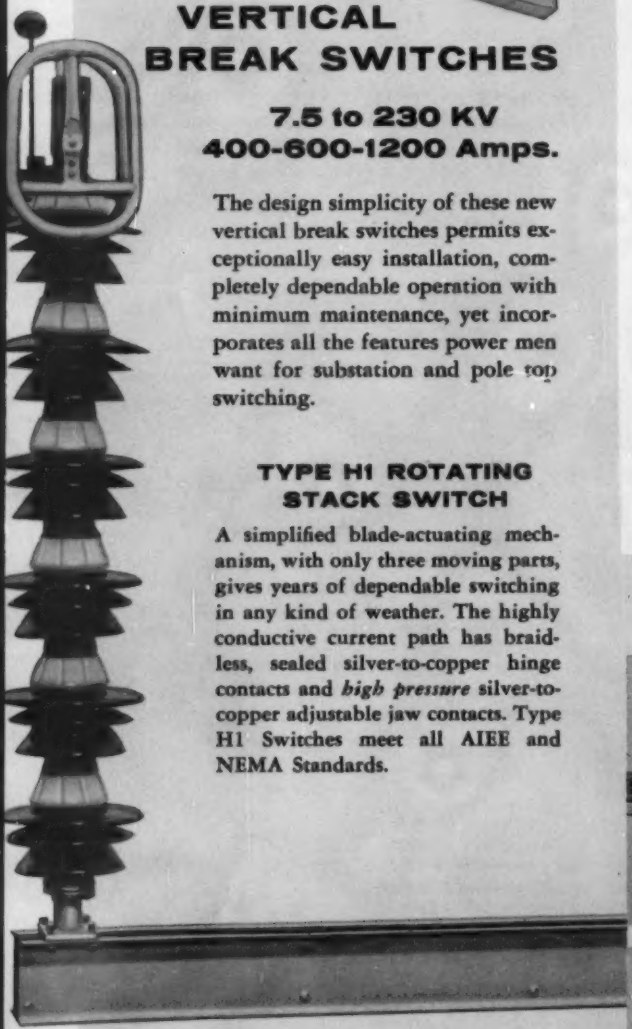
VERTICAL BREAK SWITCHES

7.5 to 230 KV 400-600-1200 Amps.

The design simplicity of these new vertical break switches permits exceptionally easy installation, completely dependable operation with minimum maintenance, yet incorporates all the features power men want for substation and pole top switching.

TYPE H1 ROTATING STACK SWITCH

A simplified blade-actuating mechanism, with only three moving parts, gives years of dependable switching in any kind of weather. The highly conductive current path has braidless, sealed silver-to-copper hinge contacts and *high pressure* silver-to-copper adjustable jaw contacts. Type H1 Switches meet all AIEE and NEMA Standards.



230 KV (1050 BIL)

HORIZONTAL BREAK

Type S Side Break Switch

Here's a ruggedly-built, economical switch for sectionalizing, disconnecting, by-passing, and isolating. It is easy to install – to operate – and has the mechanical strength and thermal capacity necessary to withstand today's extremely high fault currents without damage. Current path has braidless, sealed silver-to-silver hinge contacts and high pressure silver-to-copper self-wiping jaw contacts. 7.5 through 69 KV, 400-600-1200 Amps.

Type C Center Break Switches, with the same features, are available in ratings 41 to 161 KV, 600 and 1200 Amps.

Type

Designe
single v
lower in
of way
features
offer br
silver-to
to-copp
comple
mized.
Amps.

These Chance Switches have self-wipi

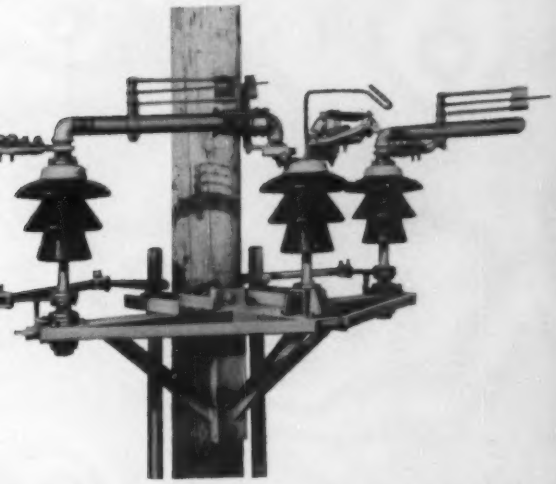
Jaw and blade conta
to provide effective s
abrasion each time
silver-to-copper for
applied high pressure
under heavy short ci

Top illustration sho
switches. Pressure is
adjustment can be m

Lower illustration s
tical break switch j
contact, deflecting t
with minimum oper
stant pressure by no

on today and tomorrow!

K SWITCHES



ype GS GOABS (Group Operated Air-Break Switches)

signed for vertical phase-above-phase mounting on a gle wood pole. This single pole mounting means ver initial and maintenance costs and minimum right way requirements. Built with the performance tures of the Type S Side Break Switch, GOABS also er braidless current path construction with sealed ver-to-silver hinge contacts and *high pressure* silver-copper jaw contacts. GOABS feature all-welded, mpletely assembled frames—installation time is mini-zed. Full NEMA Rated—7.5 to 69 KV, 400-600-1200 mps. 2-way and 3-way.

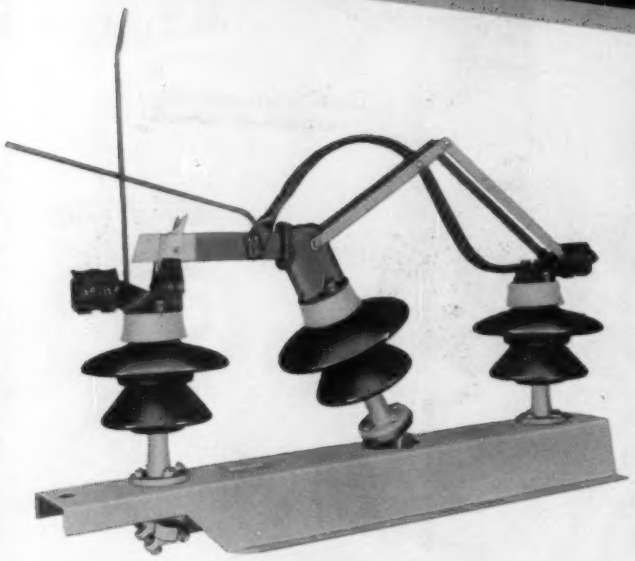
iping high pressure contacts

contacts of these Chance Switches are all designed tive self-wiping action to clean the contacts without time the switch is opened or closed. Contacts are for highest conductivity and have mechanically essure to positively hold the switch blade in position ort circuits or surges.

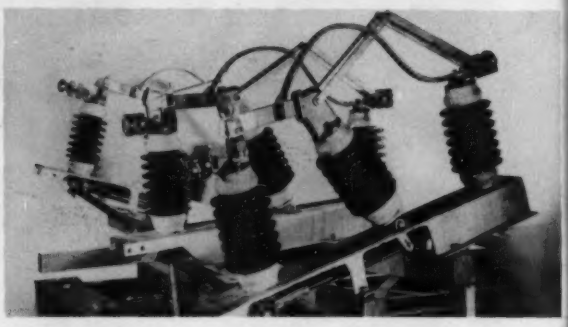
n shows the basic design used in horizontal break ure is accurately adjusted at the factory, but field be made with a wrench if desired.

tion shows how high pressure is applied on the ver-itch jaw end. Flattened blade rotates into the jaw ting the contact shoes to create the high pressure operating effort. Contact shoes are kept under con-by non-current carrying beryllium copper springs.

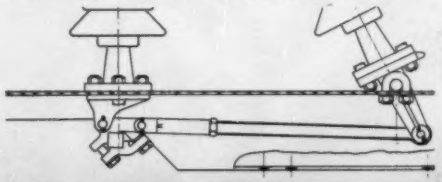
"COMPENSATOR CONTROL"... Your most important reason for selecting Chance Tilting Insulator Switches



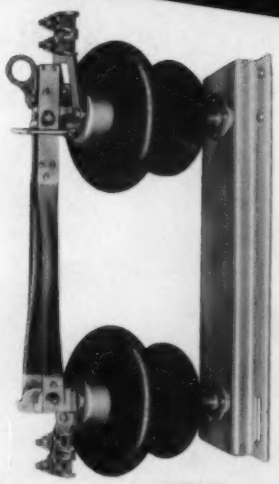
Even the most extreme warping of crossarms will never distort the mounting of gang-operated switches as greatly as the torture rack test shown at right. But even if it did—Chance Type WN or VN SWITCHES would still open and close uniformly and easily. The reason?... Chance Compensator Control that operates each phase independently of the others—that eliminates closing shock and gives extra leverage for smooth, effortless operation. Compensator Control also keeps the operating force in line with the blade motion.



There are other features you'll like, too—easy installation of the interphase shaft without "threading"... extra wide tilting insulator mounting that eliminates sideplay... deep-drawn bases to protect the operating mechanism... flanged edges that won't cut into wood supports... ice-breaking "crowbar action" of the blade, made possible by a pivoting pin in the blade, that makes it easy to open or close these switches under the most severe ice conditions.



CHANCE Disconnect Switches ruggedly built for extra years of service



CS57-4

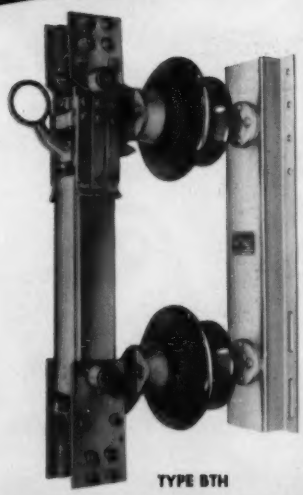
TYPE BT

Reliability of operation and reliability of performance are design characteristics of the Chance BT line of hookstick disconnect switches. Rigid blade design and self-aligning contacts mean positive closing even when it is necessary to operate with heavy side thrusts. Blade latch and centered contact pressure hold switches securely closed against heavy current surges. Pry-out action gives extra leverage for easy opening. 7.5 through 115 KV, 200 to 1200 Amps.

NEW 2000 Amp. Type BTH—7.5 through 46 KV

Features *high pressure*, silver-to-copper contacts; toggle-action of jaw applies high pressure with minimum operating effort. Double blade-latch holds switch firmly in closed position; releases easily with a pull of the hookstick.

Rugged, straight-through design provides high conductivity path; rigid square-hollow blade and bus-bar copper construction give security against damage from heavy fault currents.

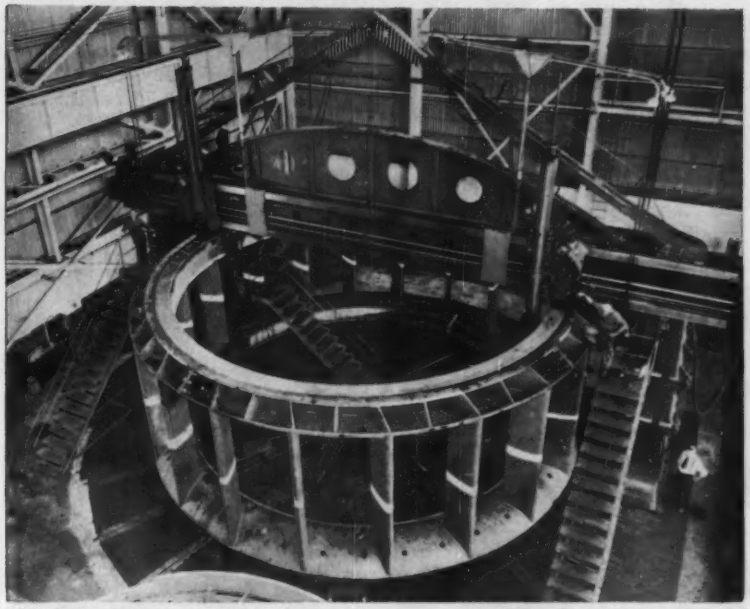


TYPE BTH

Descriptive Bulletins on all these new Chance Switches are yours for the asking. See your Chance Switch Representative, or write A. B. Chance Company, Centralia, Mo.

A·B·CHANCE CO·

ABC INDUSTRIES



GIGANTIC SIZE of vertical boring mill at S. Morgan Smith Co's York, Pa., plant is brought out by comparison with size of men. Part in mill is turbine stay ring

Firm Uses 42-Ft Boring Mill

Vertical unit at S. Morgan Smith & Co's York, Pa., plant machines hydraulic-turbine components to close tolerances

A vertical boring mill which can machine parts 42 ft in diameter and weighing many tons has been installed by S. Morgan Smith Co. The machine is used in making components of hydraulic turbines at the company's York, Pa., plant. Parts are machined to tolerances as close as minus zero and plus 0.001 in.

In the above picture, a turbine stay ring is being machined. The tool-bearing rail is mounted on three pairs of blocks or pedestals, 48 in., 72 in., and 79 in. in height. By this combination of blocks, a piece as high as 21 ft may be machined. Extensions to the basic 27-ft dia table permit a piece 42 ft in diameter to swing between the columns of the mill.

Two rams carry the tools; each has a 96-in. vertical travel. Head feeds are electronically controlled independently on each ram, with push button controls pendant on each side. The table can be controlled from either pendant. The feeds range from 0.001 in. to 1 in. per rpm. They are electronically synchronized with the speed of the table, an operation which is frequently performed mechanically on other machines. Table speeds range from 0.090 rpm in low gear to 6.25 rpm in high gear. The table is powered by two 100-hp d-c motors connected in series, each with a range of 550 to 1380 rpm.

Turbine components larger than 42 ft in diameter can be machined. For this situation the rail and pedestals are removed and the piece to be machined is bolted to the floor rails surrounding the table. A machine tool is then mounted on the table. The table has d-c and a-c outlets with slip ring connection, permitting the tool to be operated on the revolving table and within the piece to be machined.

When the rail height is to be changed, the rail is unbolted from the pedestals and removed by an overhead crane. The blocks may then be bolted or unbolted as required. Because of this operation, over 100 control wires were strung through a section of oil supply hose (visible mid-right of the picture) which formed a flexible conduit.

A small generator house was added outside the plant and adjacent to the mill to house the 200-kw motor-generator set for the table feed motors, the various electronic controls, and a ventilating set-up to maintain near-constant temperature around the electrical equipment.

Elliott Awarded Contract for Fort Peck Generators

Elliott Co, Ridgway Division, has been awarded a contract for two 42,105-kva, 128.6-rpm vertical hydraulic turbine-driven generators, in the amount of $1,826,421, for installation at Fort Peck Dam, Garrison District, Corps of Engineers. This dam is located on the Missouri River in Montana.

These generators are to be driven by Francis-type hydraulic turbines and are to be installed in the second powerhouse at this dam. They will be the largest generators of such type so far manufactured by Elliott Co, it is reported. Outside diameters of these machines measure 35 ft. Foreign competitors also bid on this equipment.

Reliance-Master Merge

Reliance Electric & Engineering Co, Cleveland, and Master Electric Co, Dayton, Ohio, are reported to have approved in principle a proposed combination of the two companies. It is to be effected by the exchange of 450,000 shares of Reliance common stock for the assets of Master. The proposed combination is subject to approval of shareholders of both companies. Management and operating personnel at Master will carry on as a separate operating division.

(More M&M on page 104)

New Line of Transformers Put on Market by GE

A new line of power transformers with significant improvements and benefits has been announced by General Electric's Power Transformer Department at Pittsfield, Mass. The transformers, called "Preferred Design" (PD), incorporate electrical flexibility with mechanical features and accessories. These were chosen only after a survey revealed the preference of a majority of utilities. The new transformers can be built in any rating from 5,000 to 50,000 kva.

"We can deliver Preferred Design transformers 6 to 12 weeks faster," said J. B. Monk, manager of power transformer sales. "Drawings approved for construction purposes will be furnished with every proposal. To assist utility planners, advance information on dimensions, weights, and operating characteristics for representative PD units will be available."

Delivery on PD transformers will range from 10 to 19 weeks, compared to 16 to 31 weeks for other than PD units, Monk continued. Use of a 705 electronic data processing machine has speeded the design process where, for example, certain reactance calculations can be done 3,800 times faster than by hand methods, and complete transformer designs take minutes instead of weeks.

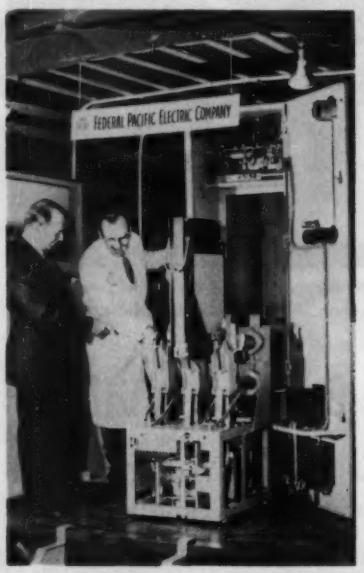
The line includes three-phase OA, OA/FA, OA/FA/FA, and FOA cooled units, with and without load tap changing, at 69, 115, and 138 kv. The PD transformers will have a base design for easier handling, better grouping of cooling equipment for accessibility, and, on units above 12,000 kva, a new cabinet to house controls and indicators, Monk stated.

Sangamo Occupies New Office Building

Sangamo Electric Co is now occupying its new office building adjacent to the engineering building at Springfield, Ill. New address is 1200 North Eleventh St.

Here are located the executive offices, also the integrated sales and engineering forces of both power equipment and electronic component divisions. This three-story brick structure with basement has a total office area of approximately 40,000 sq ft.

Communication between the Marion, Springfield, Ill., and Pickens, S. C., plants is by direct wire teletype. At Springfield a pneumatic tube system permits transfer of written information between all plant and office areas. This is the initial installation of its type with four loops and electronic control.



Federal Pacific's Breaker on Tour in Western States

A mobile exhibit is being used by Federal Pacific Electric Co to introduce it's new type DST air circuit breaker to utility executives and consulting engineers. The breaker is transported in an all-weather highway truck for demonstrations in western states.

The new air breakers are supplied with 5 and 15-kv ratings for continuous 2,000-amp loads. The 15-kv unit is said to interrupt 500 kva loads satisfactorily. Features of the breaker design include metal cladding for indoor or outdoor service and drawout construction.

Federal Pacific type DST air circuit breakers, originally designed and built in San Francisco, are now being manufactured by the company's Eastern Switchgear Division at Scranton, Pa.

M & M BRIEFS

Wagner Electric Corp's common stock was admitted to trading on the New York Stock Exchange. Trading started May 8, and the stock opened at $53.75 per share.

Ebasco Services, Inc, has opened an office at 120 Montgomery St, San Francisco, Calif. This will be headquarters for a staff of consultants who will serve clients located in the Western Region of the United States. Harvey K. Breckenridge has been appointed manager of the office.

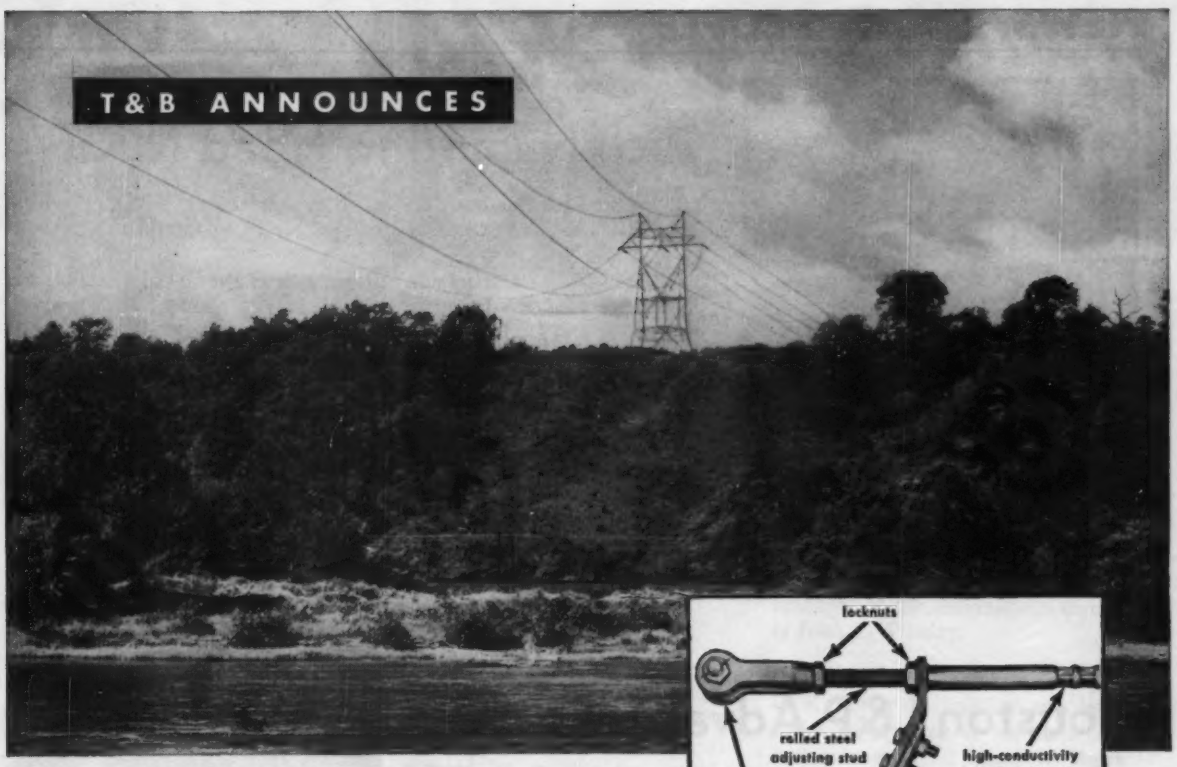
General Electric Co is supplying eleven electric utilities with automatic dispatching systems to serve as "nerve centers". Each system will enable exact dispatching of power in accordance with the rise and fall in consumer and industrial demand. Two systems are reported operating satisfactorily; two are expected to be in operation soon; and remainder are scheduled for operation this year.

Curtis Lighting, Inc, has opened its new New York sales office and show room at 60 East 42nd St. At the same time the Strats-Lux, a ceiling-size "floating" fixture was introduced for office lighting. This fixture, which does not join the walls, consists of a fluorescent grid system concealed by suspended aluminum framework holding vinyl plastic louver-diffusers.

Koppers Co Loses Poles in Yard Fire in Maine

A fire in the North Yarmouth, Me., pole yard of Koppers Co, Inc, on May 9 destroyed between 2,000 and 2,500 Western Red cedar and yellow pine utility poles during the recent dry period.

The company's offices and mechanical equipment escaped damage, and no employees were injured. About half the total stock of poles escaped the flames, the poles lost being confined to one side of the yard. New poles were ordered. A grass fire in the neighborhood appears to have been the cause of the trouble.



a new concept in transmission dead ending!

DEAD END CONNECTORS PERMIT SAG CORRECTION AFTER JOINT IS COMPLETED

Now you can adjust conductor sag to specification after the strain connection has been made! Four inches of clevis adjustment available provides great sag adjustment. For example: in a 700 foot span of 795,000 CM A.C.S.R. sagged at 50% of ultimate strength, the 4 inch clevis adjustment will allow 4 feet of sag adjustment.

The new dead end connector gives many important advantages: transmission line dead ending at river crossing and over rough terrain is simplified, more economical; "bundled" cables can be easily sagged with complete uniformity; line measurement errors can be readily compensated.

T&B Dead Ends are available for all commercial sizes of A.C.S.R. and all-aluminum conductors in three types: single bolting pad, double bolting pad, and with an integral compression loop connection.

For complete specifications on the new dead ends, as well as the complete new catalog of T&B Method transmission line connectors, tools and accessories, send the coupon below.

AUTHORIZED DISTRIBUTOR T&B ENGINEERED

LOOK FOR THIS SIGN — IT'S THE MARK OF AN AUTHORIZED DISTRIBUTOR

THE THOMAS & BETTS CO. INCORPORATED

14 BUTLER STREET, ELIZABETH 1, NEW JERSEY

Please send me the new T&B Method Bulletin 70

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Rich Named to Head NEGEA

John F. Rich has been elected to succeed Floyd D. Campbell as president and chief executive officer of New England Gas & Electric Association.

A graduate of Dartmouth College and Harvard Law School, he joined the NEGEA board of trustees in 1947 and became general counsel in 1949. For the next five years he served as treasurer of the Algonquin Gas Transmission Co. At present he is a director of that organization.

Campbell, who has been president since 1938, now becomes chairman of NEGEA's board of trustees. He will continue on a full-time basis until his retirement on September 1, and thereafter will act as chairman and consultant.

JOHN F. RICH

Houston L&P Advances Estill

Houston Lighting & Power Co's board of directors has announced the recent election of J. F. Estill, Jr, to the position of vice president of the utility.

Before his promotion the new vice president had served as company purchasing agent since 1946. He has been associated with Houston Lighting & Power since 1927, when he joined the Texas utility as a budget engineer.

Estill, who obtained his electrical engineering degree from Texas Agricultural & Mechanical College in 1925, was graduated from Houston Law School in 1929. At present he is serving as chairman of the member relations committee of the Purchasing Agents Association of Houston.

J. F. ESTILL, JR

Parry Becomes VP

SAMUEL R. PARRY

Samuel R. Parry has been elected vice president of Combustion Engineering, Inc.

In his new capacity he will continue as general manager, Chattanooga Division, the firm's largest manufacturing operation. Parry has been with Combustion since 1923 when he joined as a cooperative student while attending Georgia Institute of Technology.

L-M Unit Ups Everhart

JAMES G. EVERHART

Line Material Industries has named James G. Everhart vice president-general manager of its Illinois Edison Porcelain Division.

His promotion follows 19 years with L-M in various engineering posts, including chief engineer, Transformer Division. His most recent post as manager of L-M's fibre products plant has been assumed by Walter Matzelevich.

WSE Award Honors Cisler

Recent recipient of Western Society of Engineers' annual Washington Award was Walker L. Cisler, left, president and chairman of the board of Detroit Edison Co. The plaque, presented at the annual award dinner by WSE President George L. Jackson, cited Cisler "For outstanding and untiring service to his country and mankind by making the world a better place to live through electric power."

PERSONAL BRIEFS

John D. Lemon has been named assistant treasurer and assistant secretary and **U. J. Farr** assistant treasurer of Indianapolis Power & Light Co.

Recently promoted in Dayton Power & Light Co's Electric Operation Division were **Dwight R. Freidline,** to assistant to **Kenneth G. Oxley,** vice president-manager of electric operations; **Frank N. Wones,** supervisor, overhead lines department; and **Eugene H. Fischer,** supervisor, electric division office. In the Greenville district, **A. K. Brandon** was named Western Division engineer; **J. W. Dunn,** electric supervisor, and **R. B. Birt,** assistant manager.

Albert M. Gruber, Washington Water Power Co division manager, will assume the new post of technical research analyst on June 15.

San Diego Gas & Electric Co's **E. C. Saunders** has been named to the new post of customer accounting supervisor.

At Puget Sound Power & Light Co, **Will Farsje** has been appointed Western Division sales manager to succeed **G. L. McDonald,** who has transferred to the Northern Division in a similar capacity. In addition, **Al Couch** was named residential sales director, general sales and commercial departments and **C. A. Scheyer** became local manager at Puyallup, Sumner, and Orting.

Niagara Mohawk Power Corp has advanced **Owen K. Brown** to chief electrical engineer, system project engineering department.

Joe N. Kirk is new chief structural designer of Public Service Electric & Gas Co's electric engineering department. In other promotions, **Donald S. Lord** became manager of industrial relations, commercial operations department, and **Joseph P. Fiedler** was named assistant industrial relations manager.

Westinghouse Electric Corp's Sunnyvale Division has appointed **Leonard N. Goodell** manager of electrical products and **Fenton L. Tippett** manager of mechanical products . . . New vice presidents of Canadian Westinghouse Co, Ltd, are **Edward E. Orlando** and **John A. Campanaro.**

New assistant general managers of sales at Preformed Line Products Co are **R. F. Hollitz,** headquarters staff functions, and **F. L. Irvin,** representative-jobber functions. **J. W. Ramey** has been named manager of operations at the Palo Alto plant.

Thomas W. Metz was recently appointed manager of the Mid-Atlantic region of Allis-Chalmers Industries Group. Succeeding him as manager of the Indianapolis district is **John L. Wiedey.**

Riverside-Alloy Metal Division of H. K. Porter Co, Inc, has appointed **Julius C. Hydrick** as assistant general manager . . . **Loren D. Barre** is new assistant to the vice president of RT&E Corp.

Harza Engineering Co has named **Chester E. Bauman** an associate. Bauman is a specialist on hydroelectrical plant electrical and transmission line design.

Joseph T. Ryerson & Son, Inc, has designated **Robert L. Larson** as general manager of the new Indianapolis, Ind., plant now under construction. At the firm's Wallingford, Conn., steel service plant, **William J. Waller** was made manager of the work order department and **Richard T. Rollison** has become manager of the reinforcing steel products department.

OBITUARY

Roland P. Borden, 56, general superintendent of New Jersey Power & Light Co since 1950, died recently after an extended illness.

Fred H. Sargent, 86, president of Lawrence (Mass.) Electric Co, died recently after a short illness.

James R. Sullivan, 58, treasurer of Montana Power Co for the past eight years, died recently.

TO BUILD YOUR LIGHTING BUSINESS . . .

Enter The 1957 International

Stories on top winning entries will be published in ELECTRICAL WORLD

Local publicity will stimulate lighting business!

$5,400.00 in cash prizes will be awarded!

Have you completed an outstanding lighting job since January 1st, 1956? Do you have one planned—or working—to be finished before October 25th, 1957? Why not let that job bring you extra profit . . . and industry-wide recognition? Enter it in the 1957 International Lighting Competition!

The competition is open to any individual who is either the owner or manager, or an employee of any of the following types of business, provided he complies with all the requirements outlined in the official rules of the competition: 1. Electrical Contractor. 2. Electrical Wholesale Distributor. 3. Architect or Engineer. 4. Electrical Utility.

The contest opens March 15th, and closes October 25th. Announcement of award winners will be made during the week of November 11, 1957.

The competition is sponsored by three McGraw-Hill publications: Electrical World . . . Electrical Construction and Maintenance . . . Electrical Wholesaling . . . with the cooperation of the National Lighting Bureau (National Electrical Manufacturers Association).

Commercial, industrial and institutional lighting installations winning cash prizes will be certified by the National Lighting Bureau, NEMA, providing the installation plans meet certification standards. Certificates will be presented to all cash prize winners, and honorable mention winners. In case of tie, duplicate awards will be made. Wherever practical, awards will be made locally; if possible at electrical group meetings.

Send in the coupon below for detailed information on the 1957 International Lighting Competition. Make your outstanding lighting job pay off in extra cash, and valuable public acclaim!

LIGHTING CLASSIFICATIONS:

Lighting installations are divided into six separate and individual groups. Separate awards will be made for each classification, within each contestant division. The installation classifications are:

1. **Industrial**
2. **Store**
3. **Office**
4. **Institutional**
5. **Outdoor Lighting**
6. **Residential Lighting**

PRIZE AWARDS:

The 120 cash prizes offered, total $5,400.00. There are five prizes for each of the six installation classifications, and these prizes are offered within each of the four contestant divisions. The prize awards for each classification and within each division:

First Prize: $100

Second Prize: $50

Three Prizes: $25 each.

JUDGING:

Competent and fair consideration for each entry has been assured through appointment of nine individuals, each a well-known authority in the field of illumination, to serve as judges. These individuals will form three panels of three members each, to judge the separate lighting classification groups. The decisions of the board with respect to awards and all other competition matters are final and binding on each participant. The competition and awards are subject to all applicable local, state and federal laws and regulations.

Lighting Competition!

OFFICIAL COMPETITION RULES:

RULE 1 – Application to enter the Competition must be made in writing. Applicant may use an Official Entry Application form, which will be supplied by the Lighting Competition chairman upon request. (In any case where the applicant is unable to obtain an Official Entry Application form, he may send in his request to enter by letter).

RULE 2 – Any individual–who may be the owner or manager, or an employee of any of the following types of business – may enter the contest. These types of businesses, which are to be known as Contestant Divisions, are: electrical contractor; electrical wholesale distributor; architect or engineer; and electric utility. Either individual or joint entries may be made; joint entrants must specify which Contestant Division they are entering.

RULE 3 – Entries must be made in one of the following Installation Classifications: industrial lighting; store lighting; office lighting; institutional lighting; outdoor lighting; residential lighting.

RULE 4 – Contestants or their firms must have been responsible for either the design, layout, sale or installation of the lighting installation covered by each entry. The contestant will state this eligibility by describing in detail in each entry the part he took in the design, layout, sale or installation. In the case of joint entries, each contestant must state in the entry the work for which he was responsible.

RULE 5 – A contestant may submit any number of entries.

RULE 6 – Each entry must cover one or more of the following:

a. A lighting installation for a single specific visual requirement.
b. A lighting installation for a specific area, large or small.
c. An overall lighting installation for an entire building, project or general area.

A lighting installation using any make, or brand, or type of electric lighting equipment, and based on any lighting system design or layout, regardless of whether such lighting equipment, lighting system design or layout conforms with recognized standards for good lighting practice, may be enter 1 in the Competition. The Board of Judges, however, will judge all entries based on those factors conforming with recognized standards of good lighting practice.

RULE 7 – Each entry must be submitted separately, in an official Competition Entry folder bearing an official Registration Number as assigned by the Competition chairman.

RULE 8 – All entries, to be eligible in the Competition:

a. Must be mailed on or before the closing date of the Competition (October 25, 1957), and must be received by the Competition chairman on or before November 4, 1957.
b. Must cover lighting installations completed within the period between January 1, 1956 and October 25, 1957.

RULE 9 – In submitting an entry, the contestant agrees to be bound by all rules of the Competition, and to abide by the decision of the Board of Judges, which will be final. All entries become the property of the sponsors of the 1957 International Lighting Competition, and no entry will be returned. All entrants, by submitting entries, further agree to grant the sponsors full reproduction and publication rights.

MAIL THIS COUPON FOR RULES AND ENTRY FORMS:

Berlon C. Cooper, Chairman
1957 International Lighting Competition
330 West 42nd Street
New York 36, N. Y.

Please send me the rules brochure and _____ entry forms for the 1957 International Lighting Competition.

Name _____

Company _____

Address _____

City _____ Zone _____ State _____

MEETINGS CALENDAR

MAY

National Association of Electrical Distributors—49th Annual Convention, Sheraton Park and Shoreham Hotels, Washington, D. C., May 26-29.

JUNE

Electric Companies Advertising Program—Management Group, Palmer House, Chicago, Ill., June 2.

Electric Companies Public Information Program—Steering Committee, Palmer House, Chicago, Ill., June 2.

Eighth Annual Conference on Industrial Research—Sponsored by the Department of Industrial and Management Engineering of Columbia University, Arden House, Harriman, N. Y., June 2-7.

American Management Association — General Management Conference, Statler Hotel, New York, N. Y., June 3-5.

American Society of Refrigerating Engineers—53rd Annual Meeting, Hotel Fontainbleau, Miami Beach, Fla., June 3-5.

Edison Electric Institute—Annual Convention, Palmer House, Chicago, Ill., June 3-5.

National District Heating Association—48th Annual Meeting, The Homestead, Hot Springs, Va., June 3-6.

Electric Association—Chicago Electrical Industry Show, Conrad Hilton Hotel, June 4-6.

American Institute of Electrical Engineers—Industrial Power Rectifiers and Semiconductor-Metallic Rectifiers Committees, Morrison Hotel, Chicago, Ill., June 4-5; Summer General Meeting, Sheraton Mount Royal Hotel, Montreal, Quebec, June 24-28.

American Society of Mechanical Engineers—Semiannual Meeting, Sheraton-Palace Hotel, San Francisco, California, June 9-14.

Public Utilities Association of the Virginias—Accident Prevention Conference, Daniel Boone Hotel, Charleston, W. Va., June 14; Sales and Publicity Committees, Charlottesville, Va., June 20-21.

American Society for Testing Materials—Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 16-21.

Industrial Management Center — Fourth Annual Material Handling Training Conference, Lake Placid, New York, June 16-29.

American Society for Engineering Education—Annual Meeting, Cornell University, Ithaca, N. Y., June 17-21.

Canadian Electrical Association—Annual Convention, Manoir Richelieu, Murray Bay, Quebec, June 19-21.

Wisconsin Utilities Association—Annual Convention, Accounting Section, Kings Gateway Hotel, Land o' Lakes, Wisconsin, June 23-25.

Michigan Electric Association—Grand Hotel, Mackinac Island, Mich., June 23-26.

American Society of Heating and Air Conditioning Engineers—Semi-annual Meeting, Manoir Richelieu, Murray Bay, Quebec, June 24-26.

• **American Public Power Association**—Hotel Biltmore, New York City, June 25-27.

• **National Machine Accountants Association**—6th Annual Conference, Conrad Hilton Hotel, Chicago, Ill., June 26-28.

AUGUST

Western Electronic Show and Convention—Annual Meeting, Cow Palace, San Francisco, Calif., August 20-23.

American Institute of Electrical Engineers — Pacific General Meeting, Yakima, Washington, Aug. 26-30.

SEPTEMBER

American Institute of Electrical Engineers—2nd Special Technical Conference and Exhibit on Magnetic Amplifiers, Hotel Penn Sheraton, Pittsburgh, Pennsylvania, September 4-6; Sixth Annual Industrial Electronics Symposium co-sponsored with Institute of Radio Engineers, Morrison Hotel, Chicago, Ill., Sept. 24-25.

Instrument Society of America—12th Annual Instrument Automation Conference and Exhibit, Cleveland Auditorium, Cleveland, Ohio, Sept. 9-13.

Illuminating Engineering Society — National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

Maryland Utilities Association—33rd Annual Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 13-14.

Edison Electric Institute—Accounting Division Organization Meeting, jointly with AGA, Lemington Hotel, Minneapolis, Minn., Sept. 19-20; Industrial Relations 10th Annual Round Table Conference, Drake Hotel, Chicago, Ill., Sept. 23-25; Meter & Service Committee, Hotel Nicolett, Minneapolis, Sept. 23-25; Electrical Systems and Equipment Committee, Cosmopolitan Hotel, Denver, Colo., Sept. 30-Oct. 1.

Public Utilities Association of the Virginias — 39th Annual Meeting, White Sulphur Springs, West Virginia, September 20-21.

American Society of Mechanical Engineers — Fall Meeting, Statler Hotel, Hartford, Conn., Sept. 23-25.

Electric Companies Public Information Program — Workshop Conference, Whittier Hotel, Detroit, Mich., Sept. 25-27.

OCTOBER

Indiana Electric Association — French Lick-Sheraton Hotel, French Lick, Ind., Oct. 2-4.

International Association of Electrical Leagues—Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, October 2-5.

• **National Electronics Conference, Inc**—Hotel Sherman, Chicago, Ill., Oct. 7-9.

American Institute of Electrical Engineers—Fall General Meeting, Morrison Hotel, Chicago, Illinois, October 7-11.

Edison Electric Institute—Area Development Workshop, Phoenix Hotel, Lexington, Ky., Oct. 10-11; Transmission & Distribution Committee, Statler Hotel, Boston, Massachusetts, October 17-18.

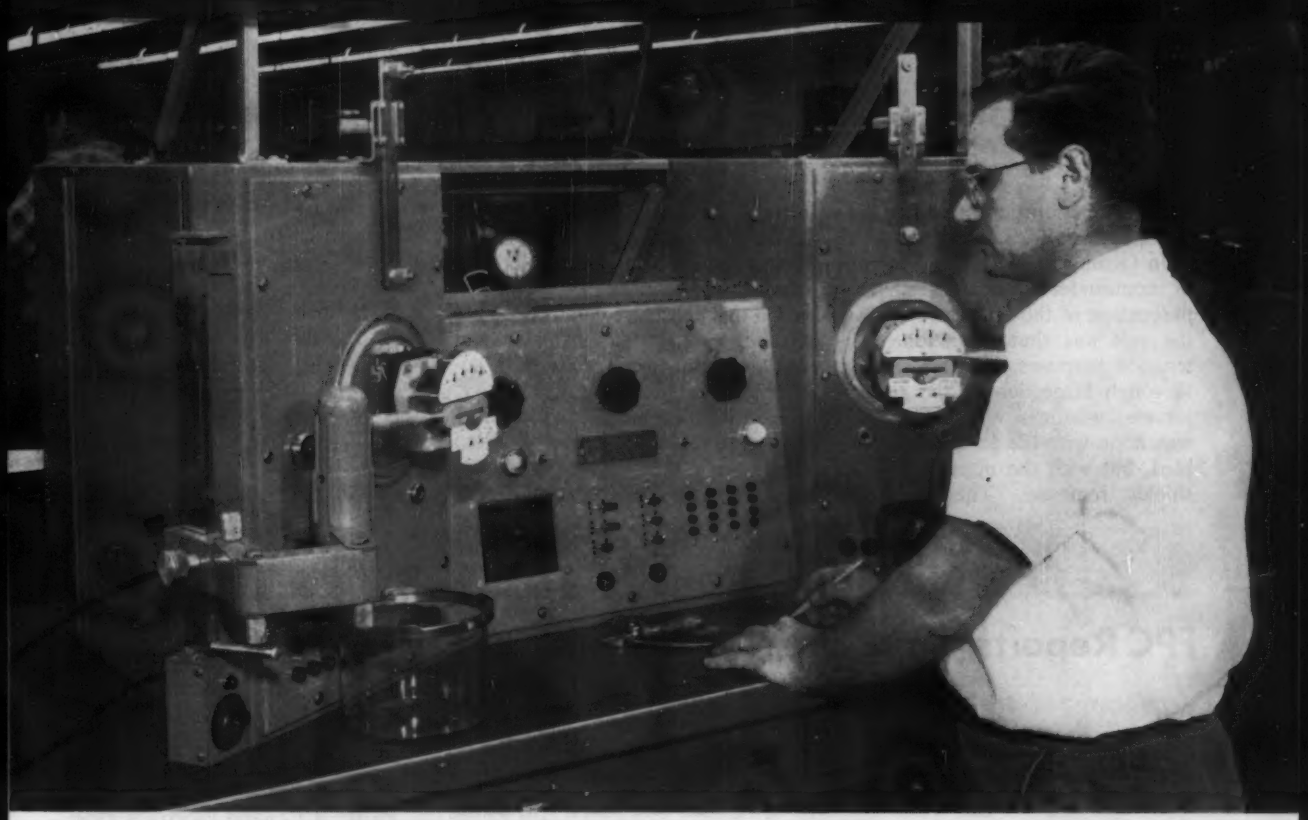
Interstate Power Club—Hotel Martinique, New York City, N. Y., October 14.

• **Atomic Industrial Forum**—Annual Conference, New York City, Oct. 28-30.

• **American Nuclear Society**—Winter Meeting, New York City, Oct. 28-30.

National Association of Railroad Utilities Commissioners — Annual Convention, Peabody Hotel, Memphis, Tennessee, October 28-31.

• Additions this week.



LOOK TO YOUR OWN RECORDS

for unbiased proof of watthour meter performance

Want to know the facts about the watthour meters on your company's lines? How they stand up in service? How accurately they retain their calibration—what it costs to keep your meters on the line? Then, look to the test records and accuracy reports of your own Meter Department—kept for your information as a company executive.

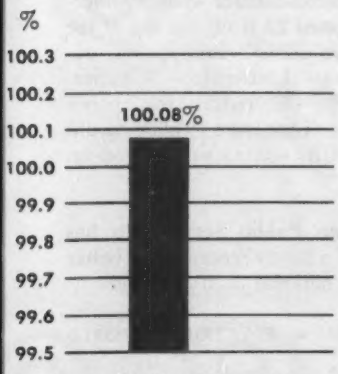
We think that you will be surprised—and pleased with the performance of the Sangamo Meters on your lines.

Shown below are meter accuracy records from one large operating utility that show the average full load accuracy and the average light load accuracy of more than 20,000 Sangamo J Meters after 8 years of service.

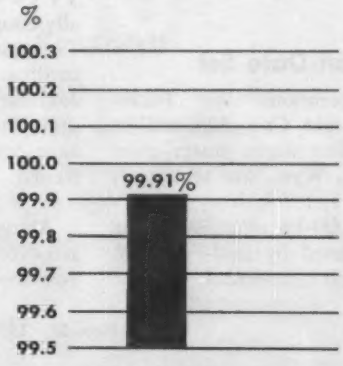
Such sustained accuracy is characteristic of Sangamo Watthour Meters. And such sustained accuracy is the reason why the J2 is your best investment in a watthour meter.

Actual performance records of 20,688 J Meters after 8 years service

Average Full Load Accuracy
20,688
SANGAMO J Meters



Average Light Load Accuracy
20,688
SANGAMO J Meters



SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

JM57-3

Liquid Cooled Stator Is Success

(*Continued from page* 84)

cate oil deterioration or sludge precipitation.

In October, 1956, after 7 months of continuous operation, a large percentage of the time at rated kva, the unit was shut down for maintenance purposes. At this time, a thorough inspection of the generator end windings was made. This was done with the field still assembled, but with the upper half endshields removed. The inspection showed excellent condition of the liquid connections to the stator windings located at the turbine end of the generator.

On this unit these connections are made up of a rigid insulator and flexible metal hoses encased in accordian-type silicone rubber boots. The collector end of the winding was also found to be in excellent condition. No leakage of the liquid into the generator was evident.

FPC Reports 456.9 Mw Net Capacity Gain

PLANT ADDITIONS DURING FEBRUARY

State	Utility	Plant	Fuel	Capacity
Ariz.	Salt River Project Agricultural Improvement	Aqua Fria # 2	S	100,000
Fla.	U. S. Army Engineers	Jim Woodruff	H	10,000
Iowa	Sumner Municipal Light Plant	Sumner	IC	1,250
La.	Natchitoches Municipal Electric Light & Power Dept.	Natchitoches	IC	5,500
Mich.	Consumers Power Co	B.C. Cobb	S	156,250
Mo.	Odessa Electric Dept	Odessa	IC	1,136
N.M.	Town of Farmington	Animas	S	6,000
N. Y.	Niagara Mohawk Power Corp	Blake	H	14,400
Ore.	U. S. Army Corp of Engineers	McNary	H	70,000
Tex.	Dallas Power & Light Co	Parkdale	S	108,800
Tex.	Garland Electric Dept	Garland	S	18,750
Tex.	Jasper Electric Dept	Plant #1	IC	1,250
Vt.	Citizens Utilities Co.	Newport 2	H	1,600
	RETIREMENTS			
Ark.	Paris Municipal Light & Water Plant	Paris	S	1,500
Ill.	Commonwealth Edison Co	Northwest	S	35,000
Iowa	Sumner Municipal Light Plant	Sumner	IC	138
Mich.	Edison Sault Electric Co.	Sault Steam	S	3,000
Minn.	Marshall Municipal Utilities	Marshall	S	645
Neb.	Consumers Public Power District	Loup City	IC	540
Ohio	Wellston Municipal Light & Power Dept	Wellston	S	2,000
Tex.	Central Power & Light Co	Freer	IC	950
Tex.	Central Power & Light Co	Mission	IC	1,440
Utah	Monroe City Corp	Lower	IC	300

U. S.	Hydro	Steam	IC	Total
Added	96,000	389,800	9,136	494,936
Retired	....	42,145	3,368	45,513
Adjustments Plus	8,000	.....	147	8,147
Adjustments Minus	.....	665	.....	665
Net Change	104,000	346,990	5,915	456,905

H—Hydro, S—Steam, IC—Internal Combustion

United States Capacity as of April 1—Hydro, 26,103,202 kw; Steam, 93,246,647 kw; IC, 2,433,278 kw; Total, 121,783,127 kw.

Salt River's New Plant

The new steam-electric power generating plant between Glendale and Peoria began serving customers of the Salt River Power District April 1. Standing as high as a 10-story building, the Agua Fria power plant at Northern and 75th Ave is of 100,000-kw capacity.

Completion Date Set

Trial operations for Pacific Power & Light Co's $23 million Dave Johnston steam power plant at Glenrock, Wyo., are tentatively set for Oct. 1, 1958.

The 100,000-kw plant was about 17% completed by mid-February, PP&L officials announced.

Power Briefs

Duquesne Light Co plans a $30-million addition to raise its Elrama station 172 Mw to a total of 500 Mw.

West Penn Power Co has sold its former headquarters building on Wood Street, Pittsburgh, to Minsky Bros, appliance dealers, who plan to lease it. West Penn now is headquartered in Greensburg, Pa.

Bonneville Power Administration's energy sales jumped 13.9% in 1956 over 1955. Revenue increased 12.7%. Energy sales were up 4 billion kwhr to 27,269,000,000. Revenue, up $7 million, hit $62.8 million. Revenue per kwhr dropped from 2.33 to 2.30 mills. Maximum demand of 4.79 million kw was hit—a 160,000-kw gain. Load factor became 68.5%, as against 1955's figure of 67.1%.

Portland General Electric's 1956 sales of 3,371,000,000 kwhr represented a ten-year increase of 140%, the company reports. Average family used 8,103 kwhr at 1.15¢ per kwhr. A decade ago, the average family used 3,197 kwhr at 1.55¢. Gross operating revenues hit $34,509,511. In 1955, they were $31,872,004.

Public Service Co of Colorado expects to have its $37-million Cherokee steam plant on the line by July, generating 100 Mw. A companion unit of 110 Mw is to be finished in 1959.

Pennsylvania Power & Light reports its 330-Mw Brenners Is. plant should be in service in 1960. The outdoor-type, bituminous-burning plant will use a cross-compound turbine generator.

TVA's flood-control system "literally chopped 22 ft off the top of the Tennessee River" this spring, according to Louisville's "Courier-Journal." Otherwise, the paper said, the Tennessee Valley could have had its second worst flood on record.

Arizona Public Service Co has achieved a safety record 40% better than the national utility average.

What Research Means to American Business

American industry plans to invest $150 billion in new plant and equipment during the next four years—more than in the five years 1952-1956. It plans to carry out this record investment even though manufacturing capacity has nearly doubled since World War II. These facts are reported in McGraw-Hill's tenth annual survey of Business' Plans for New Plants and Equipment. They contradict many long-established theories about investment in capital goods.

According to the textbooks, a high and rising level of capital investment is generally followed by a decline. The bigger the rise—so the old theory goes—the bigger the decline will be. But, after a decade of high-level investment and an especially strong rise in the past two years, industry now has plans to keep right on with near-record outlays for plant and equipment. Does this mean some new factor has been added, to change the investment cycle?

The New Factor—Research

The latest McGraw-Hill survey points out one new factor which, more than any other, is changing the nature of the investment process. This is the record outlay planned by U.S. corporations for **scientific research and development**—to create new products and develop new industrial processes. The rapid growth of research in industry, and plans for even more remarkable growth in the years ahead, are shown by the accompanying table.

This year industry plans to spend $7 billion on research and development — up 20% from 1956. By 1960 it will spend $9 billion — enough to create a major new industry.

By 1960 manufacturing industry expects sales to be up 26% — with half the increase in products that were not made in 1956.

Growth of Research and Development Expenditures

(Millions of Dollars)

			PLANNED	
	1955	1956	1957	1960
Machinery	408	506	577	704
Electrical Equipment	950	1,149	1,310	1,637
Aircraft and Parts	1,038	1,558	2,274	3,161
Fabricated Metal Products and Ordnance	134	165	174	210
Professional and Scientific Instruments	185	252	300	453
Chemicals	440	498	528	617
Paper, Rubber, Stone, Clay and Glass Products	149	174	196	233
Petroleum Products	171	205	225	277
Other Manufacturing	1,038	1,279	1,388	1,557
Non-manufacturing industries	254	310	347	419
ALL INDUSTRIES	4,767	6,096	7,319	9,269

What Research Is Doing

Here are some examples of how industrial research is opening up new markets, or compelling the modernization of old facilities:

New automatic controls in petroleum refining will raise the quality of gasoline and reduce the time required for production. A new process for recovering oil from depleted wells promises to multiply our potential reserves.

A new process for treating iron ore will permit the ore to be fed directly into steel furnaces—without the need for blast furnaces or coke ovens.

New turbine engines—made possible by the development of heat-resistant alloys for turbine parts—offer greatly increased power for aircraft, ships and automobiles.

Altogether, industry plans to introduce more new products in 1957-1960 than in any previous four-year period. It also plans new processes on a scale that will make much of our present capacity obsolete. These new products and new processes are the secret behind continuing plans for high investment.

One-third of all manufacturing firms are building new plants this year to produce new products, and by 1960 this may account for 10% to 20% of all capital expenditures. At the same time, manufacturing companies report that over half their capital expenditures in the next four years will be for modernization of equipment and introduction of new processes. Thus the preponderant share of new investment will be based on developments growing out of research.

A New Kind of Prosperity

The keen interest of U.S. business firms in scientific research points the way to a new kind of prosperity for our economy—a prosperity based on deliberate creativeness. As long as we can create new products that will offer better value to consumers or cut costs to manufacturing firms, business will continue at a high level—not at fever pitch, perhaps, and it is to be hoped not at an inflationary pitch. But based on a steady stream of new products and processes, we can have a high level of general prosperity that defies the old laws of boom and bust.

It's Not Automatic

Of course, there is no guarantee. New products do not spring up by magic as the medieval alchemists hoped they would. They are found as the result of long and expensive effort in laboratories and pilot plants. This effort requires an increasing number of trained scientists and engineers. In 1957 alone, manufacturing companies report they will need 7% more of these highly trained people in research and development. And by 1960, they will need an additional 15% to carry out planned research programs.

The effort to maintain prosperity — as well as the national defense effort — will depend increasingly on this supply of scientific and technical personnel. But if we can supply the people, industry now has the plans for a research effort that will put an end to the spectre of idle plants and idle workers.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.50 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $14.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

SEND NEW ADVERTISEMENTS TO Classified Advertising Div. of ELECTRICAL WORLD, P. O. Box 12, N. Y. 36, N. Y.

REPLIES (Box No.): Address to office nearest you c/o This publication Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

Electrical Designers—Top Salary, Scheduled Overtime at Time & One-Half Rates. Immediate Openings. Permanent Positions. Paid Holidays & Vacations. Experience required in Power Plants and Industrial Buildings . . . Marbarry Corp., 120 Greenwich St., N. Y. 6, N. Y. REctor 2-3749.

Assistant Vice President—For firm in Fairfield County, Connecticut. Must be thoroughly familiar with public utility field, including operations. To evaluate operating methods; handle preliminary development of construction and operating budgets; help analyze rates, supervise new rate studies, and act as witness in preparation of rate cases for public utility commissions; handle labor contracts and negotiations. Must be an electrical engineering graduate. Age: 35-45. Salary: to $15,000. P-5044, Electrical World.

Relay Engineers—for electric utility in Central New Jersey. Degree in electrical engineering required. Experienced in relay or related work. Age 30-45. Salary commensurate with experience. Considerable opportunity for advancement. P-5091, Electrical World.

Electrical Engineer—For rural electric cooperative serving 7000 consumers with 2600 miles of line. Graduate or equivalent experience in REA construction, operation, substations, and meter equipment. Good position for qualified person. Excellent working conditions, life and retirement insurance plan, sick leave, etc. Salary open. Write, giving complete qualifications and experience, to T. M. Brady, Manager, Eastern Illinois Power Cooperative, Paxton, Illinois.

POSITION WANTED

Division Superintendent in diesel-hydro-system, now employed abroad, available July 15th. ICS diploma in electrical engineering; age 39. Prefer eastern U.S. PW-4345, Electrical World.

Don't forget the BOX NUMBER

. . . when answering the classified advertisements in this magazine. It's our only means of identifying the advertisement you are answering.

GET CASH NOW

for your new surplus motors, controls and transformers!

NEW MOTORS AVAILABLE:

Over 5,000 new motors in stock, from ¼HP to 200 HP. Special low prices.

Write, wire or phone collect!

AJAX ELECTRIC MOTOR CORP.
P.O. Box 262, Rochester, N.Y.
Long Distance Phone I.D. 132

FOR SALE
Subject to Prior Sale

1750 feet, G.E. 15 KV AERIAL CABLE

3/C #2 (19/.658") coated copper, semi-con. tape, 19/64" Super Coronal tape, tapes 5/64" Geoprene, cabled and bound to a ½" EHS 30% copperweld messenger for 15 KV grounded neutral service. 6 only #T17881-3D, G&W I conductor 15 KV pothheads. If interested contact N. C. Stirewalt, V.P.,

Central Illinois Public Service Co.
Springfield, Illinois.

LARGE POWER EQUIPMENT
Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY, INC.
51 Howell St. Jersey City, N. J.
OL. 3-3334

"SEARCHLIGHT"
IS
Opportunity Advertising

—to help you get what you want.
—to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want
"THINK SEARCHLIGHT FIRST"

SAN FRANCISCO CITY AND COUNTY
IMMEDIATE EMPLOYMENT POSSIBILITIES
VARIETY OF PUBLIC WORKS PROGRAMS

7-1-57
Junior Engineer (Electrical) $480-$550
Ass't Engineer I (Electrical) $525-$630

For Further Information and Applications, *inquire.*

San Francisco Civil Service Commission
154 City Hall
San Francisco, California

ELECTRICAL DESIGNERS

Conduit and physical layout men. Control and wiring exp. desirable but not necessary Work in air conditioned offices of a leading hydroelectric consultant in Chicago. Good starting salaries and liberal fringe benefits. Challenging work and opportunity for advancement. Please send complete resume to Hugo Niemi, Personnel Manager

HARZA ENGINEERING CO.
400 West Madison Street Chicago 6, Ill.

ELECTRICAL ENGINEER

Electrical Engineer interested in electrical design of power plants or industrial plants. Experience not required.

Excellent opportunity with consulting engineering firm in Middle West. Liberal benefit plans and good working conditions.

Send resume of education and experience with statement of salary requirements to:

P-3234, Electrical World,
520 N. Michigan Ave., Chicago 11, Ill.

SALES REPRESENTATIVES

Growing, established, multi-plant electrical manufacturer has openings for sales representatives in (1) Alabama-Tennessee, (2) North Carolina-South Carolina, (3) Western Pennsylvania-West Virginia, and (4) lower Michigan-northern Ohio territories.

E. E. graduate or equivalent. Successful sales or related experience. Salary based on experience and qualifications. Annual cash bonus, profit sharing, merit increases. Car and expenses furnished.

Replies confidential. Send resume of age, education, experience to

P-5147, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

PROFESSIONAL SERVICES

AMERICAN AIR SURVEYS, INC.
Engineers

• Transmission Plan & Profile
• Stockpile Inventory
• Topo Maps for Reservoir Studies
• Stereo-photos for Planning

907 Penn Ave. Pittsburgh 22, Pa.

BARKER & WHEELER
Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

BLACK & VEATCH
Consulting Engineers

Electricity—Water—Sewage—Industry
Reports, Design, Supervision of Construction
Investigations, Valuations and Rates

1500 Meadow Lake Parkway Kansas City 14, Mo.

THEODORE D. BROSS LINE CONSTRUCTION CORP.
Steel Tower & Wood
Transmission Lines
Distribution & Maintenance

175 Enfield St. Hartford, Conn.

BURNS and ROE, Inc.
Engineering and Design • Reports • Surveys
Construction • Electric, Steam, Hydro Plants
Transmission • Distribution • Aeronautical Facilities • Research and Development • Nuclear, Chemical, and Industrial Plants

160 West Broadway • New York 13, N. Y.

COMMONWEALTH SERVICES INC.
Management and Business Consultants
300 Park Ave
New York 22, N. Y.

ASSOCIATES INC.
Consulting and Design Engineers
200 E. Washington
Jackson, Michigan

DAY & ZIMMERMANN, INC.
Engineers & Constructors

Transmission & Distribution Lines
Substations
Design & Construction
Reports - Valuations - Rates
Industrial & Utility

New York PHILADELPHIA Chicago

DOBLE ENGINEERING COMPANY
Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 20 N. Wacker Dr., Chicago, Ill.

ELECTRICAL TESTING LABORATORIES, INC.
Electrical, mechanical, photometric, radiometric and chemical laboratories, rendering testing, research and associated services, including certification, inspections at factories and field investigations.

2 East End Avenue at 79th St., New York 21, N. Y.

FORD, BACON & DAVIS
Engineers

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Chicago • Los Angeles

GILBERT ASSOCIATES, INC.
Engineers and Consultants

DESIGN
SUPERVISION OF CONSTRUCTION
BUSINESS AND ECONOMIC RESEARCH

Reading, Pa. New York, N. Y.

HARZA ENGINEERING CO.
Consulting Engineers

Calvin V. Davis E. Montford Fucik
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development

400 West Madison Street Chicago 6

HOOSIER ENGINEERING COMPANY
Erection and Maintenance of Electrical Transmission and Distribution Lines

1384 Holly Avenue, Columbus, Ohio

JACKSON & MORELAND, INC.
Engineers and Consultants

Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications

Boston New York

JENSEN, BOWEN & FARRELL
Engineers

Appraisals—Investigations—Depreciation Studies—Cost Trends—Reports
for Rate Cases, Security Issues, Regulatory and Accounting Requirements
Original Cost and Continuing Property Record Determination
Ann Arbor, Michigan

M. W. KELLOGG
Piping System Design Analyses

Unique model tester as well as modern digital computer facilities available for low cost, accurate flexibility analyses of the most complex piping systems.

The M. W. Kellogg Company
711 Third Ave., New York 17, N. Y.

THE KULJIAN CORPORATION
Engineers - Constructors - Consultants

POWER PLANT SPECIALISTS
(Steam, Hydro, Diesel)
Utility • Industrial • Chemical

1200 N. Broad St., Philadelphia 21, Pa.

THE LUMMUS COMPANY
Engineers and Constructors

385 Madison Ave., New York, N. Y.

Chicago . . Houston . . London
Paris . . The Hague . . Montreal
Caracas . . Bombay

CHAS. T. MAIN, INC.
Engineers

Electric, Steam and Hydraulic Projects,
Investigations, Reports, Appraisals
Designs and Construction Supervision

80 Federal St., Boston 10, Mass.

PIONEER SERVICE & ENGINEERING CO.
Consulting and Design Engineers . . Purchasing
Specialists in Financing
Accounting and other Operations

231 So. La Salle St. Chicago 4

SANDERSON & PORTER ENGINEERS
Design
Construction

New York New York

SARGENT & LUNDY
Engineers

140 South Dearborn St.

Chicago, Ill.

F. W. SCHEIDENHELM
Consulting Engineer

Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals

50 Church Street, New York 7, N. Y.

SVERDRUP & PARCEL, INC.
Engineers - Architects

Design, Construction Supervision
Steam and Hydro Power Plants
Power Systems - Industrial Plants
Studies - Reports

St. Louis San Francisco Washington

TIPPETT & GEE
Consulting Engineers

Mechanical • Electrical • Thermodynamic
Structural Design • Studies • Supervision
Power Stations • Transmission • Distribution
Industrial Plants • Process

1333 North Second Street Abilene, Texas

F. A. TUCKER, INC.
Contractors—Engineers
specialize in
Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges Dams

Main Office — 38½ Center Street, Rutland, Vt.
Branch Office — Little Rock Road, Charlotte, N. C.

UTILITIES LINE CONSTRUCTION COMPANY, INC.
Construction and Maintenance

Transmission - Distribution
Electric and Telephone Lines
Consultants

505 York Road Jenkintown, Pa.

THE J. G. WHITE ENGINEERING CORPORATION
Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

READERS MAY CONTACT
the consultants whose cards appear on this page with the confidence justified by the offering of these special services NATIONALLY.

Advertising in This Issue

Allis-Chalmers Mfg. Co.....4th Cover
6, 7, 25, 106, 107
American Brass Co..... 15
Anderson Electric Corp. 53

Bakelite Co., Div. Union Carbide Corp. 49
Baldwin-Lima-Hamilton Corp., Eddystone Div. 115
Baltimore & Ohio Railroad..... 40
Barber-Greene 61
Bell Telephone Laboratories..... 35
Blackburn Corp., Jasper 26
Blue Ridge Glass Corp..... 101
Buffalo Forge Co. 28, 29
Burndy Corp. 12, 13

Chance Co., A. B.....129, 130, 131, 132
Chase Brass & Copper Co..... 111
Collyer Insulated Wire Co..... 54
Colorado Fuel & Iron Corp..... 105
Cornell-Dubilier Electric Corp..98, 99

Directory of Engineers..... 146
du Pont de Nemours & Co. (Inc.) Grasselli Chemicals Dept. 108

Eastern Specialty Co. 120
Engineers, Directory of 146
Exide Industrial Div., The Electric Storage Battery Co. .....3rd Cover

General Cable Corp..... 8
General Electric Co., Apparatus Dept. 89, 91, 92, 93
Electronics Dept. 30

Highway Trailer Co. 32
Holan Corp., J. H..... 97
Hubbard & Co.....116, 117

I-T-E Circuit Breaker Co., Switchgear Div. 14
Imtra Corp. 110
Indiana Steel & Wire Co., Inc..... 110

Johns-Manville 147

Kearney Corp., James R.....118, 119
Kerite Co., The 64
Koppers Co., Inc. 59
Kuhlman Electric Co..... 50

Lapp Insulator Co., Inc. 38

Maryland Shipbuilding & Drydock Co. 39
Moloney Electric Co. 62, 63
Murray Mfg. Corp. 148

National Electric Coil Co..... 52

Okonite Co., The 4
Onan & Sons Inc., D. W..... 124

Page Fence Assoc. 112
Pennsylvania Transformer Div., McGraw-Edison Co. 9
Preformed Line Products Co..... 31
Pyramid Instrument Corp. 113

R T & E Corp. 114
Revere Copper & Brass Inc. 95
Reynolds Metals Co.....36, 37

S&C Electric Co. 18
Sangamo Electric Co. ...102, 103, 141
Searchlight Section 145
Simplex Wire & Cable Co..... 34
Standard Oil Co. (Indiana)..... 51
Standard Transformer Co. 60

Texas Co., The .....2nd Cover
Thomas & Betts Co., The..... 135
Tinsley & Co., Ltd. 112

Union Carbide Corp., Bakelite Co. Div. 49
United States Rubber Co. 27
United States Steel Corp., American Steel & Wire Div...16, 17

Victor Insulators Div., I-T-E Circuit Breaker Co., Inc. 121

Westinghouse Electric Corp.....33, 41 42, 43, 44, 45, 46, 47, 48, 55, 56, 57 58, 122, 123
Westinghouse Electric Corp., Sturtevant Div. 10, 11

■

PROFESSIONAL SERVICES 146

■

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES ... 145

EQUIPMENT (Used or Surplus New) For Sale 145

Seal oil IN! Seal moisture OUT!

with

J-M TRANOLSEAL

developed especially for efficient sealing against

refined oils

You can stop the dangerous and costly leakage of oil from transformers and switchgear with Johns-Manville's Tranolseal sealing compound. This permanently plastic material has a nondrying vegetable oil base. It provides effective sealing action against air (dust and moisture), inert gas, water, 13% NaCl brine as well as medium to high viscosity refined oils. Thus you can also prevent penetration by moisture and other ambient sources of trouble.

Tranolseal has excellent adhesive qualities and will not corrode or deteriorate metals, rubber or plastics. It shows good resistance to weather and aging (both painted and natural) and won't stain. Furnished in 1" diameter beads. For further information write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit (Toronto), Ontario.

Johns-Manville
SEALING COMPOUNDS

Highest profit business on the books?

Some say it is . . . some say it isn't. *The fact is, it can be!* And plenty of smart contractors around the country have already proved it.

Not so long ago, these same contractors would not have touched home modernization business with a ten-foot pole. "Costs too high . . . jobs too small . . . men don't like the work . . . why should we educate the public . . . ," they'd grumble, and a lot of other reasons were given.

Until they found that going after new construction business wasn't always too rewarding. Profits could be lean and competition tough . . . and a closely bid job could just as easily wind up on the "red side of the ledger."

The Farsighted, Profit-Minded Ones

Then a few contractors with foresight began to see the profit potential in the rewiring market.

They saw that selling modernization was one way of getting out of the ruthless and suicidal price squeeze. They saw that as prime contractors in contact with the consumer, they could profitably concentrate on selling a job "up" . . . rather than worry about how low they could bid.

They saw that when they sold a homeowner on the benefits of "living better . . . electrically," the only way competition could scuttle them was by selling a better job—not by cutting prices.

So they went out after rewiring work and started posting some of the highest profit business on the books.

$10 Million Promotion Budget

Now, for the first time in the history of the industry, responsibility for bringing in the consumer market has been split. Heretofore, the contractor has shouldered the major burden.

Now the industry has taken prime responsibility for delivering the home electrical modernization market to the contractor.

A staggering total of close to $10,000,000 will be spent in this one year to sell millions of rewiring jobs. Counting secondary activities, that figure can easily be doubled.

How To Cash In

Tie in locally with such powerful national promotions as "Housepower" and "Live Better . . . Electrically." Sell modern electrical living every chance you get—through employees, relatives, friends, through trade and civic associations.

Next, back up industry efforts to educate the homeowner. Use terms he can understand, not technical jargon. "Comfort, safety, and convenience" mean more to him than "amperages" and "voltages."

And finally, remember that home electrical modernization is a potential $5 billion market. Sooner or later its needs will have to be met. Those contractors who go after the business first will gain the greatest profits.

Published in the interests of the Electrical Industry. Reprints of this message are available by writing to Dept. EWB at:

MURRAY MANUFACTURING CORPORATION

1250 Atlantic Avenue, Brooklyn 16, New York

Murray

Manufacturers of: Safety Switches, Service Entrance and Meter Mounting Equipment, Fuse Panels, Fully Magnetic Circuit Breakers and Load Centers.

ADEQUATE WIRING SERVES AND SAVES

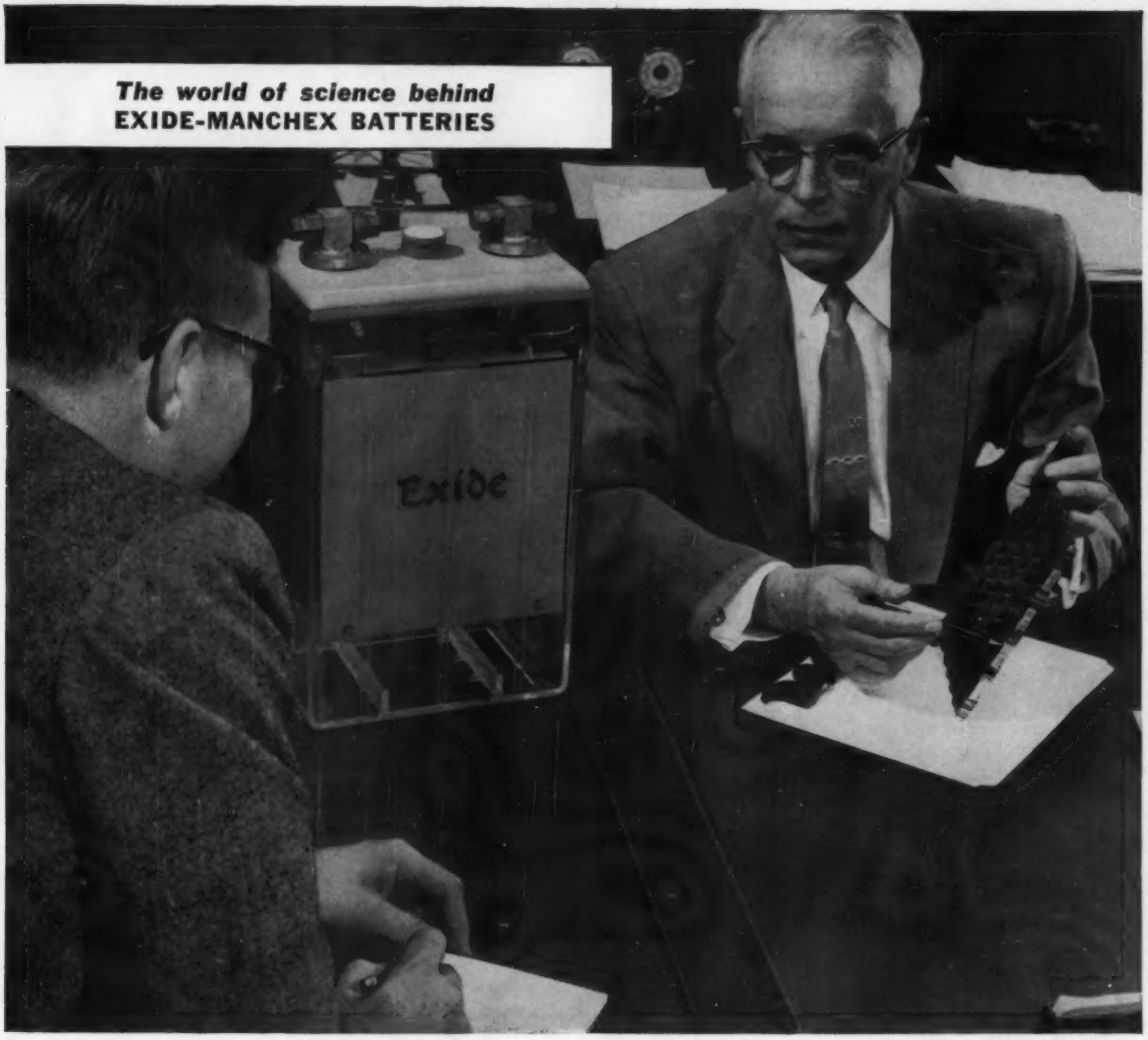
HOUSEPOWER

LIVE BETTER ELECTRICALLY

OPERATION HOME IMPROVEMENT Better Your Living

FOR A HAPPIER AMERICA AT HOME

The world of science behind
EXIDE-MANCHEX BATTERIES



Being interviewed is L. E. Wells, Director of Engineering

"The reserve lead stretches battery life"

At the Exide Laboratories—**Reporter:** You're pointing to the lead buttons in an Exide-Manchex positive plate, aren't you?

Wells: That's right. And only a very small portion of the lead is activated when the battery is made. The rest is left in reserve.

Reporter: Why do you provide this reserve lead?

Wells: To keep the battery young. As long as this reserve is there, an Exide-Manchex Battery works just as well as when it comes from the factory.

Reporter: Is that why the battery lasts so long?

Wells: Yes, and there are Exide-Manchex Batteries in use today over 20 years old with years of life left.

Reporter: Don't other batteries have a reserve lead supply?

Wells: Yes, but the reserve lead must support a plate. When it gets too thin, sometimes the plate disintegrates. The Exide-Manchex buttons are supported by a special grid that doesn't disintegrate. The reserve lead can be completely used without weakening the plate structure.

Reporter: Obviously this is an important feature in the Exide-Manchex Battery.

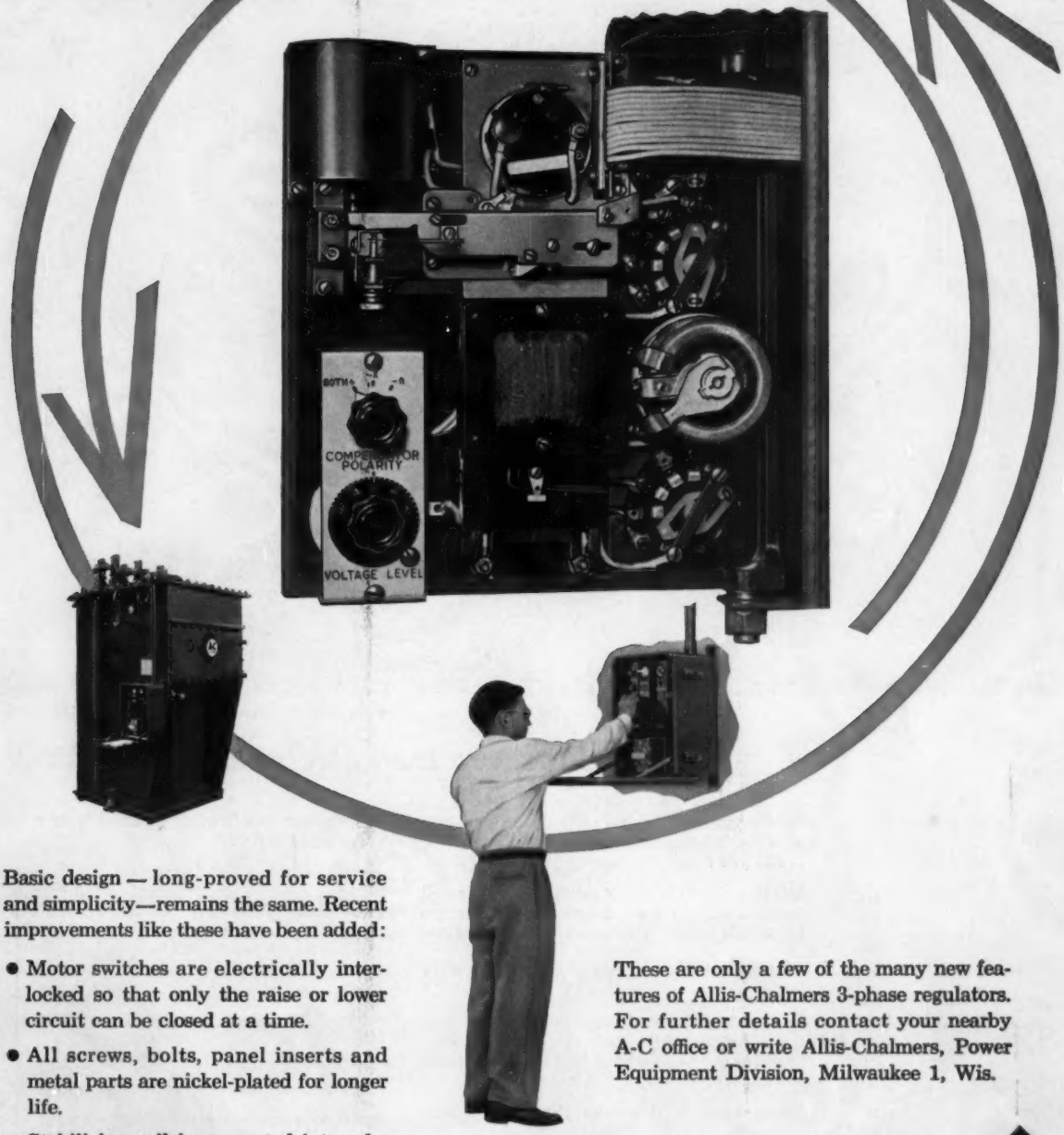
Wells: Yes it is, but just one of many engineering details that contribute to their long life.

Note to battery users: When you order batteries for float or cycle service in stationary applications, be sure to specify Exide-Manchex. Write for detailed bulletin. Exide Industrial Division, The Electric Storage Battery Co., Philadelphia 2, Pa.

THE ELECTRIC STORAGE BATTERY COMPANY **Exide**®

continued improvements in 3-phase regulators

CONTROL



Basic design — long-proved for service and simplicity—remains the same. Recent improvements like these have been added:

- Motor switches are electrically interlocked so that only the raise or lower circuit can be closed at a time.
- All screws, bolts, panel inserts and metal parts are nickel-plated for longer life.
- Stabilizing coil incorporated into solenoid of voltage-regulating relay.
- Rustproof plastic coating on open edges of control cabinet.
- Handy control diagram on inside cover.

These are only a few of the many new features of Allis-Chalmers 3-phase regulators. For further details contact your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-5408